

SB

337

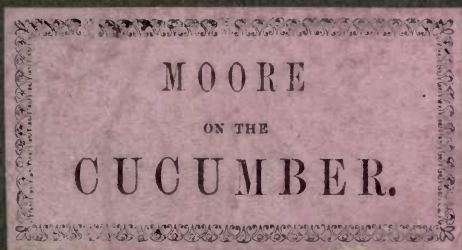
M6

1847

UC-NRLF



\$B 267 108



YA 04607

116
783



THE LIBRARY
OF
THE UNIVERSITY
OF CALIFORNIA

FROM THE LIBRARY OF
COUNT EGON CAESAR CORTI

MAIN LIB.-AGRI.

REPORT AND PROGRESS

OF THE

CULTIVATION

OF

THE CUCUMBER

WINTER SEASON

IN THE

CHAPTER ON THE

THE

OF THE

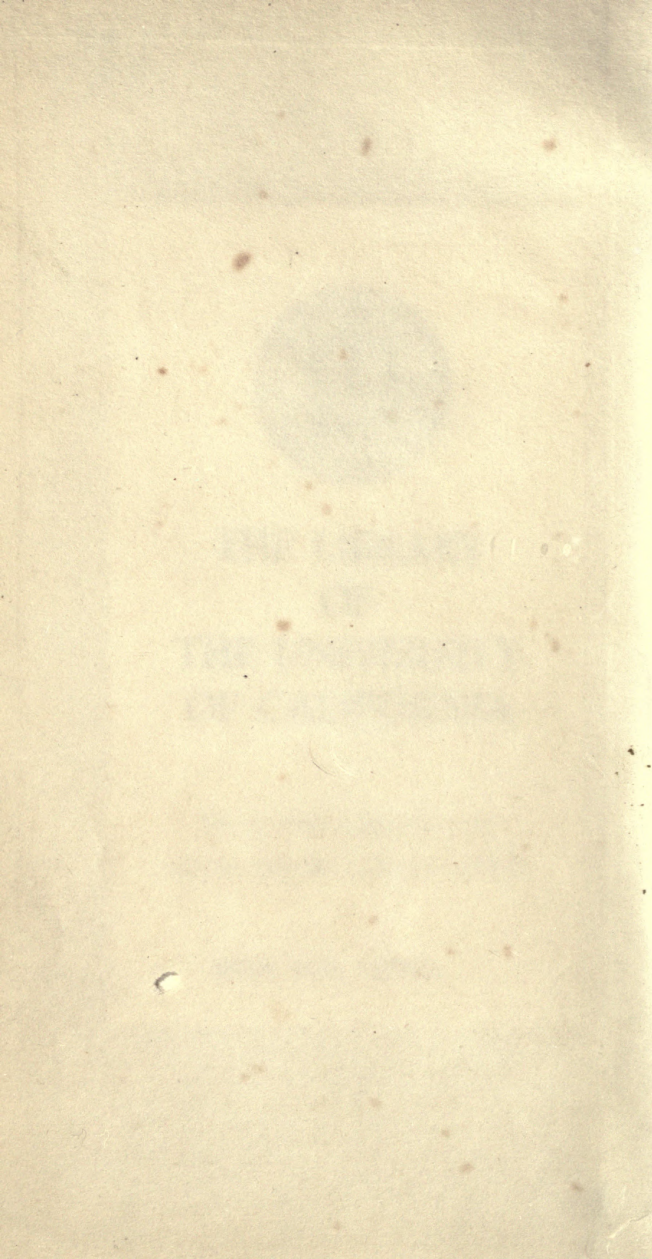
OF THE

OF THE

OF THE

OF THE

OF THE



THEORY AND PRACTICE,
APPLIED TO THE
CULTIVATION
OF
THE CUCUMBER,
IN THE
WINTER SEASON:

TO WHICH IS ADDED,
A CHAPTER ON MELONS:

BY THOMAS MOORE,
MEMBER OF THE BOTANICAL SOCIETY OF LONDON.

SECOND EDITION,
WITH AN APPENDIX, CONTAINING REMARKS ON HEATING,
AERATING, AND COVERING FORCING HOUSES; ON
TRANSPLANTING, AND THE USE OF TURF
POTS; ON WATERING: ON ATMOS-
PHERIC HUMIDITY, &c., &c.

LONDON:
RICHARD GROOMBRIDGE AND SONS,
5, PATERNOSTER ROW.

MDCCCXLVII.

THEORY AND PRACTICE
OF
CULTIVATION
OF
THE GROUND
IN THE
MAIN LIB.-AGRI.

LONDON:
PRINTED BY DAVID M. AIRD
JAMES ST., COVENT GARDEN.

5B 337

M6

1847

PREFACE TO THE FIRST EDITION.



THIS little treatise is intended as an inducement to young Gardeners especially, to seek for the reasons on which the operations of their daily practice are founded, and by which they are regulated. This announcement is here made, in order to prevent any reader from supposing that the author has unduly estimated the opinions of those who have benefited by a long course of application and experience. As, however, there can be no doubt that there is much to be learned, so is there but little question that there is also much to be unlearned, in the present state of the Science of Horticulture; and these pages are offered without hesitation, as a mite among the accumulating mass of available information on gardening subjects; and in the hope that some amongst those who are seeking to extend their knowledge, may at least be stimulated by their perusal, if they are not otherwise directly benefited.

The great truths which it is the object of this treatise to impress, are these: that the ultimate success of gardening operations does not depend on the performance of any part of them, at a particular time, or in a particular or even superior manner, but rather upon

M749317

PREFACE.

the supplying, in a natural manner, as far as possible, *all the conditions* which are necessary to the nutrition and perpetuation of plants; and, that it is within the open pathway of Science, and not the bye-ways of empiricism, that the finger-post of direction should be sought.

Royal Botanic Garden, Regent's Park,
March 2nd, 1844.

TO THE SECOND EDITION.

IN the present edition, it has been thought best to preserve the original text exactly as it appeared in the first edition. The new matter will be found in the Appendix.

The author may take this opportunity of returning his thanks to those who have noticed and commended the former edition, and of expressing a hope that the present will receive an equal share of favour.

Camden Town, Aug. 1, 1847.

CONTENTS.



CHAP. I.	PAGE
Botanical name, and affinities of the Cucumber—properties—foreign names—improvements in cultivation.....	9
CHAP. II.	
Structures—dung beds—brick pits—forcing houses—gutter system of heating—the tank system—bottom heat—description of Cucumber house—aspect—position—angle—covering,	11
CHAP. III.	
Propagation by cuttings—early fruitfulness—preservation of varieties—layers—objections to cuttings and layers—seeds—disadvantages—progressive growth—seed sowing.....	23
CHAP. IV.	
General principles of culture—importance of light—pruning and training	31
CHAP. V.	
Composition of the soil—heath soil—leaf mould—preparation of soil—charcoal—manures—liquid manures.....	36
CHAP. VI.	
Application of water to the soil—special conditions—atmospheric moisture—insects—mildew—canker—mode of watering	42
CHAP. VII.	
Regulation of temperature—principles to be kept in view—day and night temperature—deductions	46
CHAP. VIII.	
Admission of air—effect of cold air on tender plants—deterioration—evils resulting from unguarded atmospheric changes—mode of admitting air—atmospheric influence on vegetation—nitrogen—carbon	50
CHAP. IX.	
Growth of Persian Melons in summer—peculiarities of treatment—soil—watering—solar heat—light	56
CHAP. X.	
Conclusion	59

TREATISE.

CHAP. I.

INTRODUCTORY REMARKS.

THE Cucumber, *Cucumis sativa*, is supposed to be a native of the East Indies; but like many other of our culinary plants, the real stations which it naturally has occupied, are involved in obscurity: in habit it is a trailing herb, with thick fleshy stems, broadly palmate leaves, and yellow axillary monœcious flowers. In the natural arrangement of the vegetable kingdom, the genus of which it forms part, ranks in the first grand class, *Vasculares*, or those plants which are furnished with vessels, and woody fibre; in the sub-class *Calycifloræ*, or those in which the stamens are perigynous; and in the order *Cucurbitaceæ*, or that group, of which the genus *Cucurbita*, or Gourd family is the type.

The affinities of this order, are chiefly with *Loasaceæ*, and *Onagraceæ*; with the former it agrees in its inferior unilocular fruit, having a parietal placentæ, and with the latter, in its definite perigynous stamens, single style, and exalbuminous seeds. It has also some affinity with *Passifloraceæ*, and *Papayaceæ*, in the nature of the fruit, and with *Aristolochiaceæ*, in its twining habit, and inferior ovarium. M. Auguste St. Hilaire, also regards it as being related to *Campanulaceæ*, in the perigynous insertion of the stamens, the single style with several stigmas, the inferior ovarium, and in the quinary division of the floral envelope, in connection with the ternary division of the fruit.

The properties of the plants comprised in this natural family, are not numerous; a bitter laxative quality pervades many of them, a familiar example of which is the resinous substance called Colyecinthe, the production of the Colocynth gourd, in which the active purgative principle is concentrated, rendering it drastic, and irritating. Among our native plants the roots of *Bryonia dioica*, in common with the perennial roots of all the plants in the order, possess these purgative properties. On the other hand, the seeds are sweet, yielding an abundant supply of oil; and it may be worthy of remark, that they never partake of the properties of the pulp with which they are surrounded in the fruit.

The Cucumber does not possess the properties common to the order, in very powerful degree; its fruit is however too cold for many persons, causing flatulency, diarrhœa, and even cholera; by others, it may be eaten with avidity, without producing any injurious effects.

The names by which the Cucumber is recognised by the Hindoos, are *Ketimon*, and *Timou*. In the French, it is called *Concombre*; in the German, *Gurke*; and in the Italian, *Citriuolo*. As a cultivated plant, it is of nearly equal antiquity with the Vine; being mentioned by the writer of the Pentateuch, as being cultivated extensively in Egypt, above 3000 years since.

The cultivation of this plant, and the production of fine fruit at an early season, is an object of emulation among gardeners of the present day; and from this cause, many important improvements in the mode of its cultivation have been effected. The vast increase of means, arising from an acquaintance with powerful agents, formerly unknown, which are available by the present and rising races of gardeners, enable them to secure the same important results which cost their predecessors much both of labour and anxiety, with a comparatively small amount of the former, and a degree of certainty at

which they could never arrive. The agents which an enlightened age has brought under controul, are indeed powerful engines, which require much skill in their adaptation and management; but the knowledge necessary to effect this, is so firmly and inseparably connected with the first principles of cultivation, that an acquaintance with these, will at all times supply a safe and unerring guide to their application.

It is to assist the young gardener in this application of principles, to the growth of the Cucumber in the winter season, that these pages are designed; and of those who may differ from the opinions which are here expressed, it is only required that they should receive a calm and deliberate consideration—a consideration unbiassed by prejudice, and unmixed with any of that feverish excitement after novelties, which with gardeners, as well as with all other classes of society, is becoming far too prevalent, and intense.

CHAP. II.

ON THE STRUCTURES ADAPTED FOR THE GROWTH OF CUCUMBERS.

I will preface the following remarks on the structures adapted for the growth of Cucumbers, by stating, that a forcing house, a pit, and a common frame, present the means of bringing this fruit to its perfection, equally, one with the other, provided that a course of cultivation suitable to the structure, is followed out; the comparative merits of each, depend not so much on the nature of the results which may be obtained by adopting them, as on the facilities they afford for the attainment of those results.

The use of the common frame, and the ordinary hotbed of fermenting manure, nevertheless involves these difficulties:—the fermentation is liable to become excessive, and that in a very rapid manner, and also to decline as rapidly; the heat, when declining, cannot be speedily restored in unpropitious weather; it is materially checked in its action, by that particular state of the weather, which renders its efficient action most essential; it involves almost an infinitude of labour; and after all, it is uncertain in its action: when such difficulties as these, are overcome, Cucumbers can be grown to perfection, on dung beds, assisted by the common garden frame and sash.

The brick pit, when heated by fermenting manure, presents difficulties of the same nature with the preceding, though in a less powerful degree: but when these structures are heated by means of hot water, in any of its various modes of application, there need be no irregularity, nor uncertainty in its action; because the supply of the elements of vegetable developement, and of the agents by whose aid they are applied, may, to a very great extent, go on uninterruptedly.

A forcing house, whilst it secures all the advantages which are presented by a pit, combines with these, some important points which are peculiarly its own: by adopting a pit, we provide a structure of which Cucumbers manifest their approval, by thriving equally as well as in their more ancient location on a dung bed; but further than this, a pit enables us to dispense with much of the labour, and all the filth, and the uncertainty which are consequent on the use of fermenting manure as a means of keeping up the temperature in which they are grown. In a small forcing house, besides these advantages being secured, all the operations of care and culture, can be performed just when they become necessary, without exposing the tender foliage of plants which have been sub-

mitted to an artificially elevated temperature, to the chilling influence of cold air, which is admitted whenever the sashes of an ordinary frame or of a pit, are opened, in order to bestow these necessary attentions. It may be urged that a dung bed has still the advantage, on the ground of economy; but when a fair calculation is made of labour and loss or anxiety on the one hand, and of duration on the other, such an assumption, will be quite untenable. Neatness, convenience, certainty, and economy, are the principal points of advantage which are gained by the adoption of pits heated by means of hot water, over those of a structure, depending for its supply of heat, on the aid of fermenting masses; whilst the attainment of a still greater degree both of convenience, and of certainty, which may be secured by cultivation in forcing houses, point out at once the advantages which render such houses, preferable to pits.

The application of the gutter system of heating, was not long since thought to be an improvement of great importance, and there can be no question but that it affords a means of regulating the moisture of the atmosphere of hothouses, in conjunction with the temperature, which prior to its introduction had not been attained; and as such, it is worthy of extensive adoption: it requires however some judgement in its adaptation to particular structures, and to render, it suitable, to effect any particular object for which it may be employed.

The tank system as a means of applying bottom heat, employed either in conjunction with the gutters, or with ordinary piping, to supply heat to the atmosphere, is the most important advance which has hitherto been made towards supplying the wants of those plants, which require such peculiar aid; and with reference to the Cucumber, it may be regarded as furnishing a new era in its cultivation.

The importance of bottom heat in the culture of tender plants, has always been well known by its practical effects. The mean temperature of the soil, at a slight distance below the surface, is universally above that of the superincumbent air; and consequently some degree of bottom heat is always supplied to plants, in a state of nature. Naturally, by means of subterraneous heat, and also by the absorption of the sun's rays during the time they are forcibly directed towards the earth, it possesses the means whereby any material degree of cold at the roots of plants is prevented; and when the soil is acted on by the unveiled sun of an eastern sky, we cannot but feel certain, that even a considerable amount of heat must be experienced: hence arises the importance of taking advantage of every ray of sun which our climate affords, when the culture of the Cucumber, or of any native of warmer latitudes, is attempted out of doors in this country; and also of using every possibly available means of increasing rather than diminishing the temperature of the soil: and hence too, in forcing not only the Cucumber, but also every other plant which requires to be submitted to a confined atmosphere, and an elevated temperature, arises the necessity of providing such a degree of warmth at the root, as may tend to keep its vital powers in a vigorous state of action; it will effect this, by acting in conjunction with moisture, as a solvent of the food which is primarily contained in the soil in a solid form, but can only be taken up by the capillary action of the spongioles of the roots, when converted into a fluid state. The science of Chemistry has taught us that the ingredients composing the soil, act on, and dissolve, and combine with each other, in various ways, sometimes being simply dissolved and held in solution, and at other times, entering into new combinations, and forming new compounds; but in all cases, the natural agents, heat and moisture, are necessary to produce these results, and to present to the tender roots of plants, food

so duly prepared, as to be fit for their assimilation. Warmth in the soil, acts beneficially also, by preventing the sudden or undue interruption of the excitability of plants growing in it, which would be likely to result from the lowering of the temperature of the plants by evaporation, were it not for the action of the antagonist force, existing in and exercised by the heated soil, which heat, is communicated to, and absorbed by the plants.

It may be regarded as an established and universal rule, that all plants require the soil, and the atmosphere in which they are cultivated, to correspond with the natural circumstances under which they flourish; and as it has been repeatedly ascertained that the soil is naturally a degree or two above the temperature of the atmosphere, we have certain and unerring data for the application of bottom heat, and no more powerful evidence than this can be desired, to condemn at once the application of a *very powerful degree of heat*, at the roots of plants.

The importance of bottom heat in the culture of tender plants, being a practical fact established beyond question, another consideration arises as to the best means of producing it, and of regulating its application. Various substances and materials have been submitted to a process of fermentation, and so employed to effect it: stable manure, tanner's bark, and the leaves of trees, are among the principal of these materials, and either of them will supply just what the plants require, as truly as these wants can be supplied by any other means; but from their very nature, they are violent, and fluctuating, and ephemeral in their action, and setting aside the labour which the employment of them necessarily involves, we have in these particulars, the special points in which the tank system of applying bottom heat far excels them: it is uniform, and constant, in its action; there need be no apprehension of the soil becoming overheated, for the source whence it derives its warmth ought never to

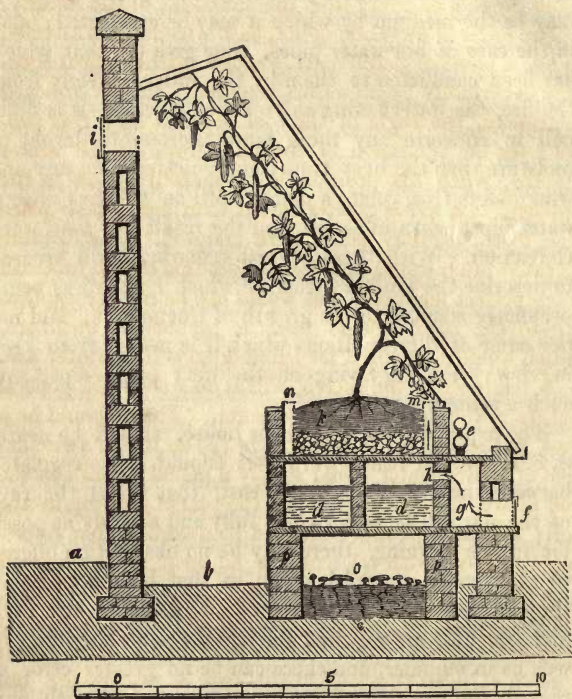
boil; neither need there be any fear of its decline, or of a want of power, for when once thoroughly heated, a body of water will part with it in such a manner, that a very little attention to the fire, and a very little expenditure of fuel, will maintain its temperature for an almost incredible length of time; and as to power, it never should for a moment form a question, because a powerful degree of bottom heat ought never to be applied: a close attention for one or two hours during the twenty four which form a day, will maintain any apparatus in an effective state of action, if it is properly erected. How different is this, to what has been in days now past! when in rigorous weather, with the heat of his dung bed declining, the cultivator knew that at the peril of his crop, he scarcely dared to attempt to revive it, without involving a more serious because an accelerated evil; at any rate, if at an immense sacrifice of labour, his dung casings were replenished piece by piece, he knew too well, that often many days would elapse, before their action would be efficient and satisfactory, unless indeed an unlimited supply of materials, were in a constant state of preparation. By means of the tank, a fire could be lighted up, and the required effect produced in as many hours, as days would have been formerly required.

What has been already advanced, tends to the conclusion, that small forcing houses are preferable, and in the end more economical than pits and dung beds; and that the tank as a means of supplying bottom heat, is preferable to the use of fermenting materials; *because the results in each case, are more perfectly under controul.* Whilst on this part of the subject, I may be allowed to mention an error which is somewhat prevalent: We frequently hear of the humid nature of the heat given off by hot water pipes, in comparison with that derived from such appliances, as a flue; it is not unfrequently asserted, that the heat thus derived is so moist, so genial, so peculiarly

adapted to plants: there can be no doubt but that the heat thus obtained is infinitely preferable to that obtained through the medium of flues, generally speaking; but its superiority consists rather in its purity, its freeness from noxious gasses, than in its possessing a greater degree of moisture. Heat—that is—caloric, is the same, whatever may be the medium by which it may be conducted; and in the case of hot water pipes, they give off that which has been conducted to them by the water, directly from the fire, the water acting as a mere conductor; it is difficult to conceive any thing more thoroughly devoid of moisture than the heat thus communicated: let any one who doubts this, place a damp cloth on a series of hot water pipes when in action, and the result will soon work conviction. With these general remarks, I will proceed to describe the kind of structure which I regard as being peculiarly adapted to the growth of Cucumbers; and notice some of the conditions which it is necessary to keep in view: the engraving on the next page, represents such a structure.

The aspect of the Cucumber house, should be nearly S. S. E; or in other words—it should be so regulated between the points south and east, that whilst the rays of the sun will be admitted as fully and as early as possible in the morning, there may be no obstruction offered to their more powerful action as that body approaches the meridian. In the growth of all tender plants, light and sun heat are required during the winter months as well as in summer, and there can be no greater error as regards the erection of structures devoted to such purposes, than to provide for their admitting the direct rays of the sun in the earlier part of the day, at the expense of refracting and thereby weakening, to a greater degree than is really unavoidable, the power of the noon-tide rays of that invigorating and life-sustaining agent: during the summer months, though plants then require both light

and sun heat, yet the case is different; the sun's rays have then much greater power, and it is found that their influence is sufficient, without at all times admitting them directly on the plants growing in these artificial atmospheres.



The position of the Cucumber house, with reference to the ground line, must be determined by local circumstances; if the situation and sub-soil be dry, it may be carried below the surface in the manner represented in the annexed engraving, of which (a) is the ground line,

(*b*) the pathway, and (*c*) the lowest point excavated: the same course may be adopted if the soil, though not naturally so dry as this, can be rendered so by thorough drainage; but when the ground does not admit of perfect drainage, the structure must be sufficiently elevated to avoid the risk of injury from the dampness of the locality.

The angle of elevation is not, as it is sometimes asserted to be, a point of indifference, though mathematical accuracy is certainly by no means required: in the annexed engraving, the angle of the roof is about 55° , this provides for the admission of the sun's rays in the winter months, when his position is comparatively low in the horizon, to a much greater extent than could take place if a more ordinary slope were adopted. A still more elevated pitch would doubtless effect this object in a still more perfect manner; but would not be equally applicable to the requirements from a permanent structure, which would be wanted for summer as well as winter use.

A reference to the sketch, will at once shew the general nature of the internal arrangements. There should be a tank (*d*) supported by brick piers (*p*) in which a circulation of heated water would supply a genial warmth to the soil above, and to the roots of the plants growing in the soil; this tank should be heated by a small boiler, conveniently placed with reference to adjacent arrangements; a series of iron pipes (*e*) attached to the same boiler, would supply the requisite heat to the atmosphere. It may perhaps be thought that the application of the gutter system of heating would in this case be preferable; but as there would be a perfect command of moisture, as will be explained further on, it is desirable to have dry heat also, under controul, and this can be better effected by means of the pipes than by adopting the gutter plan of heating. I cannot in this place forbear protesting against the limited surface of piping generally employed in heating plant structures; what is thought to be just

enough to maintain a given temperature, is usually after minute calculation, the quantity which is made use of, and the consequence is, that under adverse circumstances, the apparatus is necessarily worked at its highest pitch; and I believe that the application of heat in this form, whether it be by means of an hot water apparatus, or by a common flue, is most inimical to the plants submitted thereto. The admission of air, is a point which as far as I am aware, has never been effected in the manner represented in the sketch: it would be thus effected;—a series of apertures (*f*) should be provided at intervals along the front wall, which would externally be closed by small sliding shutters, and would communicate internally with a chamber (*g*) formed between the front wall and the side of the tank; this chamber would also communicate, by a series of openings, (*h*.) with the interior space *above the water* in the tank, and from this space, through the covering of the tank, tubes (*m*), also placed at intervals, would be carried up through the soil, close to the side of the wall; these tubes should be furnished with caps or valves, so as so admit of the communication being stopped at any time. In applying this to the admission of air, we must not loose sight of a series of ventilators, (*i*), placed in the back wall of the house, which are of precisely the same nature and construction as the apertures (*f*), already spoken of. I shall have occasion hereafter, to notice the admission of air, but it will be well in this place, to explain the action of the plan proposed for that purpose: when it is judged that a change of the internal volume of air is requisite, the ventilators (*i*) are to be opened, which admits of a portion of the rarified air to pass off; the ventilators (*f*) are also to be opened, and by means of the action of these ventilators on each other, a portion of external air is taken in; this enters the chamber (*g*), which is warmed by its contiguity to the tank, and here becomes partially rarified, and rises to the

top of the chamber; the apertures (*h.*) admit it to the interior of the tank, where it becomes not only thoroughly warmed, but also imbibes a degree of moisture proportionate to the degree in which it becomes heated, and thence it enters the house by the tubes or shafts already spoken of. The advantages of warming and moistening the air thus admitted, are very important ones; for when either a cold or dry state, of the atmosphere prevails, its influence is very injurious to plants in these confined situations: cold raw air, when it comes in contact with the tender foliage of the plants, has the effect of chilling the sap in its progress through their tissue, and thus lessening their excitability, when it should be increased; whilst dry air acts as an incessant drain upon the vegetable juices, which it abstracts through the stomates and pores of the leaves and stems. When cold air is admitted to any position where it can unite with caloric, and not in an equal ratio with moisture, it necessarily becomes arid, and in that state it eagerly combines with moisture in any form with which it can come in contact therewith; and consequently if cold air is admitted to a plant structure, where it can have the means of combining with heat, faster than with moisture, it would be brought into this arid state, and would supply its voracious appetite, by abstracting the juices of the plant. It is a very important question how far this state of things is connected with many of the diseases as they are called, to which plants are subject; for my own part, I believe it to have a very considerable influence in the production of many of them. A shallow bed of soil (*k.*), is all that would be required; for in the winter season, there is nothing gained by encouraging a very luxuriant and gross state of growth: the composition of this soil will be noticed hereafter: beneath it, and resting on the top of the tank, should be placed a layer of coarse open rubble, not less than six inches in thickness; and among this rubble

by means of tubes (*n*), placed at intervals along the bed, I would occasionally pour considerable quantities of water, in order to maintain a due regulation of moisture in, and throughout the soil, among which the vapour arising from the water would ultimately rise. Beneath the tank a space (*o*), might be provided, which would serve admirably either for the cultivation of Mushrooms, or the forcing of Rhubarb, or Sea Kale. Transverse partitions should be introduced into the bed of soil, so as to divide the roots of each plant from those of its neighbours: this arrangement will admit of a complete succession of plants being maintained, by the removal of those which have become old and debilitated, and the substitution of young and vigorous ones; and this obstruction of the roots, will not be injurious, for the Cucumber does not by any means require to be permitted to extend its roots at random, but will readily submit itself to any rational regimen, with regard to the area from whence it is permitted to extract its food. A portion of soil sufficient to support one or two plants, could by this arrangement be renewed as occasion might require, and the roots of the contiguous plants would suffer no injury from the operation. The pathway of the house, should be paved so as to admit of its being occasionally washed and cleansed.

It will be found to be highly economical in reference to the consumption of fuel, to provide the structure with the means of being covered at night. Shutters of light frame-work, covered with any waterproof material, would be found to answer the purpose admirably; they should be elevated a few inches from the surface of the glass, and they should be arranged so as to confine a body of air, which acting as a very slow conductor of heat, would serve to prevent that incessant drain upon the temperature of the internal atmosphere, which takes place when the material employed is in contact with the glass, as well as when coverings are altogether absent. This

would not be the only advantage, for as the covering would to a great extent prevent the radiation of heat from the internal atmosphere, so would it also prevent the necessity of the application of so powerful a degree of fire heat at night; and thus the plants would be permitted to enjoy that natural season of repose so essential to their well being, instead of being forced into growth by reason of a high temperature kept up, solely for the purpose of obviating the external cold.

CHAP. III.

ON THE PROPAGATION OF THE CUCUMBER.

Cucumbers are propagated by cuttings, by layers, and by seeds; the two former of these methods being frequently practised by those who have conveniences to keep their plants growing throughout the year; the latter being adopted either through choice or necessity, by the majority of cultivators, or those whose means will not enable them, even if they desired it, to keep up continually a successional growth.

Propagation by cuttings has many advantages to recommend it, especially when viewed in connection with the production of winter fruit. The plants raised by this mode of treatment, in comparison with those raised from seeds, are less gross and succulent in their nature, and more subdued in their manner of growth; whether it may be that having mature and perfectly formed parts, they are enabled to assimilate their food more rapidly, than young and imperfectly formed plants can do; or whether it is owing to any difference in the balance between the roots and leaves, which latter organs, in cuttings, and the for-

mer, in seedling plants, may be regarded as predominant, does not appear quite evident, probably the effect depends partly on each of these supposed causes. They are moreover, sooner in arriving at a fruit-bearing state, by reason of a universal natural law, by which the inflorescence and fructification of a plant becomes more general and perfect, in proportion as the plant attains proximity to its perfect developement; which effect, is owing to the more perfect elaboration and preparation of the materials, which when so prepared, furnish the means of perfecting the organs of reproduction. For the same reason, the operation of budding a portion of a seedling fruit tree, on a matured stem, is practised, in order to accelerate its fruitfulness; which result generally follows, in consequence of the difference existing in the nature of the food elaborated by the mature plant, and that deposited by one in an infant state. Thus it is also, that cuttings of flowering plants generally, are far sooner in arriving at a blooming state, than seedling plants of the same species: flowers and fruit being formed only by the aid of the perfectly elaborated sap; which is taken up into the system, and assimilated in the plant, in proportion to the number of healthy and mature leaves, in a full state of action: during the younger stages of growth, the crude material imbibed from the soil, is only partially elaborated, and in this state, is only converted into food suitable and destined to increase the foliaceous organs; but when these latter are in full and vigorous action, a supply of matter, not increased in quantity, but enriched in quality, becomes laid up in the store-house and structure of the plants; and it is by means of this matter, aided by the natural agents, that the nature of the developement is changed from being simply that of the organs of nutrition, to that of the more perfect and important organs of reproduction. Besides the precocity of plants propagated by cuttings, there is also another advantage resulting from the prac-

tice, and that is the preservation of particularly desirable varieties; the Cucumber is a plant which readily admits of hybridization, and although the result of this is sometimes to give rise to superior varieties, yet if impregnation is permitted to take place promiscuously, the bad qualities of particular varieties, are as likely to be combined in the succeeding race, as the good and desirable ones: this renders it important that the fruit which are preserved for seed, should have been carefully watched and protected when in blossom, from the reach of insects; which often effect the requisite union, in consequence of the pollen adhering to their bodies, and thus being brought into contact with the stigma. I need scarcely say, that where only one variety is grown in any particular structure, the chances of admixture are less numerous.

The manner in which the operation of propagation by cutting is performed, is very simple: the tops of healthy growing shoots are taken off, at about two or three joints in length; they are then planted in deep pots, which are about half filled with light earth, such as decayed vegetable matter, and then covered by laying a piece of glass on the top of the pot; a simple and effective protection is thus formed, the sides of the pot acting as a partial shade, the glass admitting light sufficiently abundant to secure the action of the leaves, and maintaining a calm and moist atmosphere: the pots are to be plunged in a gentle bottom heat, and the cuttings will soon become rooted; after which they may be treated as established plants.

Propagation by layers, is another method similar to the last, of which it is a mere modification; and those points which mark the superiority of the one, are equally applicable in the case of the other. The operation may be performed in various ways: thus the branches may be layered at once into the soil, when these are trained

close to its surface, and they will thus grow on with renewed vigour: when required for removal to other positions, they may be layered into pots of light soil, in doing which, a convenient branch may be brought down, secured firmly at a joint to the soil, and slightly covered therewith, when it will soon become rooted: another plan, is, to suspend in convenient places, pots having large holes beneath; through these holes, the points of growing shoots are introduced, and the pots having a little moss in the bottom, are then lightly filled with vegetable mould: they may also be propagated, by enveloping a joint of a growing shoot lightly with moss; the moss should be kept continually moist, and roots will soon be emitted into it, and when enough are produced, the plant may be detached.

Either of these methods of propagation will secure not only healthy, but fruitful plants, in a short space of time; and this latter point will be found to be one of no small advantage. The principal objection which may be urged against their adoption, is that they necessarily involve a process of transplantation, which under any circumstances, and however carefully performed, must be regarded as an evil rather than otherwise. It may be thought that the *check* arising from transplantation may do good, by preventing too great luxuriance of growth, and thereby tending to accelerate fruitfulness; but even if this result may be apparently produced by such means, it is surely far more natural to check the plants, by withholding a portion of food, rather than by mutilating the organs by which their food is conveyed to them, and then actually placing them in a position where food is still more abundantly supplied than before. It is very questionable however, how far what is called a "check" is justifiable as a means of inducing fructification; for if fructification be the most perfect state at which a plant can arrive, there does not seem to be much rationality in adopting any

such means as a “check” in bringing about this perfection of developement. A *check* applied as a means of accelerating maturity, can only be regarded as an expedient, rendered necessary by previous defective treatment.

The most commonly practised as well as the most natural method of propagation, is by seeds, and this will generally be found to be also the best method, if the conditions required by its adoption can be properly carried out. There is however, one decided disadvantage attendant on the raising of Cucumber plants intended for winter forcing from seeds; and hence in a great measure arises the apparent superiority of propagating by extension: the disadvantage consists in the exceedingly succulent and lax nature of the tissue of the young plants; owing to that natural principle, by which their increase and extension is most especially provided for during the infant stages of their existence: the result is, that in consequence of the deficiency of light and solar heat, which are the grand agents of vegetable fructification, their sap does not become sufficiently elaborated, nor their tissue rendered sufficiently solid by assimilation and deposition of matter, to bring about the development of floral parts; the food and moisture imbibed, instead of being sublimated and fully elaborated, is only partially acted on by the vital and natural agents, and the result is an increase of growth, but not a development of fruit-bearing parts. There is nevertheless, an advantage in raising plants from seeds, not only as regards the obtaining of improved races, but also in a cultural point of view. The science of Horticulture, does acknowledge such a thing as progression, in the development of plants; the functions of nutrition necessarily go on prior to those of reproduction or fructification, the latter being continually dependant on, as well as being the result of the former: hence we arrive at a conclusion, that *to supply uninterruptedly, ALL the elements*

which administer to the nutrition of a plant, is the most rational means of inducing a state of fruitfulness. This may at first sight be questioned; cases may readily enough be quoted, in which food has been bountifully supplied, and the plants have grown amazingly, but not fruited; if however, food had been thus supplied, in connexion with a due share of *light*, and an *excess of heat* had been avoided, we have natural evidence to prove unquestionably that fructification would have followed. An abundance of food, a high temperature, and a deficiency of light, are just the conditions which are opposed to the developement of the floral organs in plants, and are inductive of mere barren extension: not that plants grow thus, because they delight in such a state of things, but because they are thereby unnaturally excited and compelled to do so, although that growth cannot under such circumstances, become properly matured; and hence arises the impossibility of their producing blossoms.

The advantage of raising plants of Cucumbers from seeds, consists in the facility thus afforded of altogether avoiding transplantation: the roots of Cucumbers are of a very tender nature, and however carefully they may be transplanted, they are liable to sustain injury in the removal: by having recourse to depositing the seeds at once in the soil where they are intended to grow, this is entirely obviated, and there can be no possible reason why the conditions necessary to germination should not be as fully supplied in a hillock of soil, as when a portion of the soil is placed within a garden pot; this vessel can certainly have no influence in producing more perfect or healthy germination, whilst the mutilation of even the most careful act of transplantation, may tend to check the future developement of the plant.

It may be, however, that circumstances prevent the sowing of the seeds at once in their ultimate position, and in such cases, they may be sown singly in pots partly

filled with decayed vegetable mould, plunged in a milk-warm bottom heat. The temperature both of the soil and atmosphere during this period, should not be high, but such as to permit the plants to push gradually forth from their dormitory, and assume by a natural process, the functions of active vitality. In order to maintain them in vigour of constitution, they should be exposed as much as possible to light; and that, by being placed near the glass, so as to receive the rays as little broken and refracted as possible. Water should not be applied at all, until vegetation has manifested itself, and afterwards, but sparingly, whilst the plants are young, especially in prolonged periods of dull sunless weather. Plants which are thus raised, should be planted out as soon as possible, when their fibres are least numerous, as a means of avoiding in part, the injuries to which they are exposed in transplantation.

When the plan of depositing the seeds in the hillock of soil is adopted, it is necessary to arrange the soil so that any subsequent additions made to it, may not have the effect of covering too deeply the roots of the plants, neither of burying the neck of the stem beneath the surface; it should be arranged so that this latter may remain elevated above the surrounding soil on the top of a slight mound, after the whole of the soil is adjusted for the roots. I have already mentioned that the depth of soil ought not to be at all considerable, but rather shallow than otherwise, so as to expose the roots as far as possible to the influence of the sun.

It will have been seen that the plan of raising young plants from seeds, has both its advantages and its disadvantages; and in order to avoid the latter, and secure some of the former, the seeds should be sown early in the autumn, whilst there is a sufficiency of heat and light, to mature the growth they make previous to the dull cheerless days which mark the near approach, and

at length the arrival of winter. They will thus be endowed with the "stamina" necessary to sustain them, through that trying period, and though not without difficulty, yet with comparative certainty, to reward the well-directed zeal of the cultivator. It is impossible to give any very minute directions as to the time of performing these operations of propagation, for like all other gardening operations, it is not at all requisite that they should be done on any particular day, nor ought they to be done except when natural conditions are favourable to success: from ten to twelve weeks generally elapse between the time of sowing the seeds and the production of fruit, according as the season may be favourable or otherwise.

The numerous hybrid varieties which are in cultivation, render it a matter of some importance to make choice of those most suitable to the purpose; these are however so continually changing, that it is useless to attempt a record of them. The Sion house Cucumber is perhaps the best of all suited for cultivation in the winter season. The principal features which are required in Cucumbers for winter forcing, are, precocity; compactness of growth, rather than luxuriance; prolificacy, rather than extreme length of fruit; and hardiness of constitution: these, are to the gardener far more important points, than those which entitle them to rank as "prize" varieties.

CHAP. IV.

ON THE TREATMENT OF THE MATURE PLANTS.

From the time that the plants become established, which is the period of their existence now about to be considered, they require to have the elements of vegetable growth duly supplied to them, in order to secure their successful developement. It is not enough to plant them in proper soil, and duly to water them, unless attention is also paid to the temperature, as well as the constituents of the atmosphere to which they are submitted; neither will attention to these latter points be sufficient to ensure success, if at the same time, the former are neglected. A *soil* of suitable chemical, as well as mechanical composition, a pure and wholesome *atmosphere*, *water* promptly and properly applied, and *heat* duly regulated, are conditions which equally require minute care and attention in their adaptation; and these being applied upon the comprehensive, and perfectly harmonious principles of nature, will leave but little to be done in the shape of expedients, which are too frequently resorted to, as the means of counterbalancing either defective or unsuitable management. The application of these agents to the cultivation of the plant under consideration, in the winter season, will form the subjects of succeeding chapters, I will here briefly direct attention to the importance of light in the growth of plants, and then devote some space to the consideration of the subject of pruning and training.

Light is most essential to the perfect and healthy developement of vegetable organization, the performance of the functions essential to the health of plants being

dependent on its agency. It cannot indeed be assumed that plants will not continue to grow, unless they are supplied with an intense degree of light; but it is certain that the successful nature of their growth, their maturation, and their fructification, are dependent in no ordinary degree upon the nature and force of its action; for without it, the vital energies of animated beings are unable to maintain and perform the processes of elaboration, and assimilation, upon which their nutrition depends. The mere extension of vegetable tissue, may indeed go on, though less satisfactorily, under the almost total privation of light, but with the exception of cryptogamic vegetation, the organs of fructification are not under those circumstances, produced at all: the stem may be formed, but does not become solid: the leaves may expand, but their condition is imperfect; and it is only by means of the full and complete action of these organs in the nutrition of plants, that the developement of the floral parts is brought about: the roots may take up fluids, and these may be conveyed in the natural upward channels, and then dispersed among the stems and the leaves; but it is the action of solar light, aided indeed by the natural condition of the elements supplying heat and moisture, which alone, by a process of elaboration, can convert this fluid, once crude and undigested, into the compound organic substances, such as lignin, gum, starch, gluten, &c. which in their turn, are destined to minister to the support of the organs of reproduction. Growth, that is mere extension, may go on in proportion as heat and moisture are supplied to plants, but light is the agent to whose especial influence we owe the production of their active properties and secretions, and the perfection of their fruit.

If then light is so indispensable to the vegetable frame, how important it is that the structures which we devote to the cultivation of such plants as the Cucumber, which

are naturally habituated to an eastern clime, should be so designed, as to offer the least possible obstruction to its entrance: how important, too, that the glass we employ, which in its purest state, offers considerable obstruction, by refracting the rays of light, should be as transparent and untarnished as possible, so as to admit them as perfectly as can be practicable; instead of which, it is too often disfigured by an accumulation and deposit of filth, which, to say the least, must materially diminish their force: how important, moreover, that whatever coverings it may be necessary to employ during the night to prevent the outward radiation of heat, should be speedily removed in the morning, and kept off as long as they safely may be, in order to permit the inward radiation of light. When these matters are all duly attended to, our climate, at least during the winter, still offers obstruction enough to our success, in its mists, and fogs, its long dark nights, and dismal cloudy days, and therefore wisdom would teach us, to avail ourselves of all which we can grasp, by a course of untiring assiduity, and attention to such apparently trifling matters as these.

The pruning and training of the plants, are operations, to which it will be necessary to direct attention; and in the performance of which, the circumstances which may have any influence upon them, as well as the object in view, must be taken into consideration. The plants being intended to occupy a surface of trellis-work in a line nearly parallel with the glass, it will be requisite to train their primary shoots to a sufficient length to reach from the soil to the trellis, before they are what is technically called "stopped;" this operation, by removing the central bud, or axis of developement, induces the buds which are latently formed at the nodes of the branches, to push forth and become the axes of further extension: two or three of the strongest of these lateral shoots situated towards the top of the stem, should

be retained, and trained on the trellis in a direction towards the top of the house; these shoots should be placed about 18 inches from each other, and when they have reached about one-third of the length of the trellis, they also should be stopped, and thus several more lateral shoots will be produced. The uppermost strong shoot should in each case, be still trained in the same upward direction, and the others must be disposed in the most convenient form in the space between the main branches: these, that is the young lateral shoots, if they do not shew a fruit blossom at the second joint or leaf from the main branch, must be stopped, and the young shoot thus induced to push forth, will in all probability have fruit at the first leaf; if not, it must be stopped *at every leaf* as it extends, until fruit is observed. The upper portion of the branch after having extended about one-third further up the roof, should be submitted to the same process, and this must be again repeated until the whole of the trellis is covered.

No reference has yet been made to the treatment of those lateral branches where the young fruit are perceived: these should be permitted to grow until the blossoms have expanded; and then, after this, they should be stopped at the leaf next beyond the fruit blossoms. By permitting them to grow until the flowers have expanded, the attraction of the growing branch will continue to draw up a regular supply of nutriment, part of which will be devoted in its course, to assist the development of the blossoms; and besides the advantage of the growing point acting thus as a sucker to draw onwards the vital juices towards the young fruit, it will act also as an outlet, to drain off what would otherwise be superabundant and dangerous to these tender organs of reproduction. After the flowers have expanded, this danger does not exist to so great an extent, the infant fruit have new and important functions to perform, which

are peculiarly their own; and these call for a greater supply from the nutritive organs of the plant: the stopping of the branch therefore, is the means of throwing in this increased supply of food; but those who can most fully appreciate the delicacy of the functions performed by the plant at this stage of its developement, will most fully value the suggestion not to stop back the growing branch *all at once*, but to do it by successional, though not distant operations. The leaf which is directed to be left above, or beyond each fruit, will serve, both as a reservoir, to receive all the superabundant food, which may either be induced or impelled upwards; and also, as a laboratory where this food will become purified and changed by its exposure to atmospheric influence, amongst the lax tissue; and whence, an appointed portion will be returned, and devoted by a process of assimilation, to aid in the extension of the plants.

This system of pruning, with reference both to the barren and the fruitful branches, must be continued, whilst these continue in a vigorous and healthy condition; but when any symptoms of decay or of expended powers, are perceived, they should be pruned quite away, and young ones encouraged in their stead. All the pruning which has been spoken of, except the occasional removal of a main shoot, should be done at a sufficiently early period of growth, to admit of being effected by means of the thumb-nail; for like all other plants, Cucumbers are much best treated, when whatever pruning they may require, is done at that stage of growth, when the least amount of trouble and labour is required to perform it. Pruning is not under any circumstances a natural process, and when we have recourse to it in artificial cultivation, it is only an expedient, which is rendered necessary by the limited space, within which it becomes necessary to confine the extension of the plants; and since this is the case, it is far better to remove a

portion of any plant, at an early period of its growth, and thus to economize its vital energies, rather than to suffer them to be expended, and the supply to become exhausted through a superfluous developement, and then to deprive it of those very organs, by the action of which, the expenditure would be again recompensed to the vital energies.

CHAP. V.

ON THE NATURE, AND COMPOSITION OF THE SOIL.

Plants absorb fluids through the extremities or spongioles of the roots, and it is thus that those portions of the substances which serve them as their food, and are derived from the soil, are carried into their system, in a state of solution: these spongioles are not strictly to be regarded as analogous to the mouths of animals, for they are not provided with openings, and cannot imbibe even the most impalpable powders; their action seems to be more analagous to that of the lacteals in animals, for these, as well as spongioles, serve to convey fluids only. These considerations render it necessary, that in the composition of soil for the growth of plants, the following important points should be held in consideration;—it should contain a sufficient ratio of organizable matter, that is of substances which can be rendered available as food to the plants; it should readily absorb fluids, since it is only when in a state of solution, that food can enter into the structure of the plants; it should be sufficiently retentive to avoid the risk of injury by reason of the

evaporation, which takes place to a very great extent, when too great an abundance of silica is present, or when more than a due degree of porosity exists in its mechanical texture; and it should be sufficiently permeable, to prevent any thing like excess of moisture, by stagnation.

Soils composed either principally, or almost entirely of heath soil, or of vegetable mould, although very highly recommended for the growth of the Cucumber in winter, are nevertheless objectionable when applied alone, as will be evident if the foregoing principles are taken into view: it cannot however be assumed that the plants will not grow in these soils, for they grow vigorously for a period; neither can it be asserted that such soils do not contain the qualities which are necessary to administer to the nutrition of plants, for it is scarcely possible to conceive any substances which are more nutritious, or whose application in this respect is more effectual; but they are objectionable, in consequence of their becoming soon expended, and failing to maintain for any length of time, an equable degree of moisture. The cause which tends to produce this effect, is the porosity, or the want of mechanical combination in the texture of the soil; which being highly favourable to evaporation, is liable to render it speedily, and very materially dry, when exposed to the influence of powerful solar heat: the frequent application of water, does not entirely obviate the objection, for even when so applied, it soon becomes again evaporated, and thus tends to deteriorate the soil, and decrease its fertility; this it does, by taking up much of the soluble matter contained in it, and conveying it by evaporation into the atmosphere, instead of its being taken up by the roots whilst in a fluid state, and applied to the plant as a means of nutrition: when it is thus conveyed to the atmosphere, the leaves though they are enabled to take up a portion of their food from thence, are still incapacitated to do so fully, and hence, much of the fertilizing

properties of the soil, is carried off by the first current of air which passes through the structure; and the plants decline by reason of starvation, though they had been seated in the midst of plenty.

The soil which I should recommend for the growth of the Cucumber, would be composed of ingredients, capable of supplying a sufficient portion of vegetable food; of retaining a due portion of moisture, when placed under powerful evaporation; and of securing the free passage of water through its mass: the former of these conditions would be secured, by the use of mould from the decaying leaves of trees, in the proportion of about three-eighths; the latter would be ensured, by employing about one-fourth part of turfy heath mould, and one-eighth part of clean coarse sand; and the remaining quality, would result by combining these ingredients with one-fourth part of good turfy loam. The preparation of this soil should take place in the dry weather of the summer months, just previous to its being used, so that it can be frequently turned and mixed, without incurring the danger of reducing it to an adhesive consistency, which would at once render it ungenial for the roots of plants: the turfy portions both of the loam and heath soil should be piled up reversely, until the herbage and roots of the grass, become partially decayed; when required for use, it should be chopped into pieces of from two to four inches square, by the spade, and then adding the other ingredients *in a rough state*, the whole should be well mixed, without sifting, or any other mechanical operation which would have the effect of destroying its open texture. It should always be prevented from becoming saturated with water; and moreover, should never be applied to the roots of plants which are growing in a warm medium, without having been previously submitted to a high temperature, for a sufficient length of time, to have absorbed at least an equal degree of

heat, with that in which the plants might be already growing.

The admixture of charcoal with the soil, is said to be a means of adding to its nutritive qualities. Charcoal, which is nearly pure carbon, may be supposed continually to give off a portion of this gaseous substance during its decomposition, and this uniting with a portion of the oxygen contained in the air, would furnish a supply of carbonic acid gas, to the atmosphere immediately about the plants. It should however be borne in mind, that charcoal, is a substance whose decomposition except under the influence of heat, proceeds very slowly indeed, and therefore its chemical influence must not be overrated: doubtless however, the small portion which does combine with the oxygen of the air, is directly beneficial to the plants; for it is a function of the vegetable kingdom by the action of their leaves, when under the influence of light, to decompose carbonic acid, the oxygen of which is liberated, and the carbon fixed in the living tissue. It is therefore probable that a supply of carbonic acid, artificially maintained about the leaves and stems of plants, may be beneficial to them, by furnishing them directly with a portion of carbon, which they cannot absorb in a separate state. When the charcoal is made from twigs, and the small branches of trees, its decomposition is often more rapid, than when it is obtained by the usual course of manufacturing it: if the latter kind of charcoal is employed, it should be broken into pieces of a small size; and in ordinary cases, it should not be used in larger proportion than with about twice its bulk of soil, with which it should be intimately blended.

Besides its chemical action, which is probably beneficial, charcoal has a decidedly advantageous mechanical action in the composition of soils, and this is of a twofold nature:—first, in common with any similar mate-

rials, it renders the soil "open," and thus effectually favours the free passage of water through its mass: secondly, it serves as a perpetual reservoir of moisture in the soil, for in consequence of its being extremely porous, it imbibes a great quantity of water, by its force of attraction, and this it parts with slowly to the soil; in this way, there is no doubt that its action is most salutary. Probably a few pieces of charcoal placed perpendicularly in the soil, and kept continually *wet*, by the action of some little capillary contrivance, would serve as the best possible means of conducting moisture, and distributing it to the roots of plants.

It will be observed that the application of dung, in any way whatever, has not been recommended; neither do I consider it to be at all requisite, or desirable, in the culture of winter Cucumbers: luxuriance is not a consummation which it is at all desirable to attain to, a moderate, well matured growth, being far preferable; and as some care is supposed to be used to provide suitable soil, it should be of such a nature as to possess the properties, which are requisite to effect the desired end. Dung containing as it does fertilizing properties, may do well to renew the fertility of exhausted soils, which may have been under a long course of cultivation; but it is questionable, whether it ought to be admissable to any extent in pot culture, or in the growth of forced plants, in preference to a supply of wholesome unexhausted natural soil.

A very great objection to the use of dung when applied in a solid state in the composition of soils, consists, in its being presented to the roots of plants, not only in the advanced periods of their existence, but equally so, during the early stages of their growth; here must be an error, for infants, whether they belong to the animal or vegetable kingdom, are certainly not capacitated to appropriate the same kind of food, in the same proportion, as

adults. If only a small portion of soil is at first employed, and portions more and more enriched, are from time to time added, as the roots may extend, we are still liable to stumble on an objection, almost as important, though of a somewhat different nature; for we can in that case scarcely fail to injure the spongioles of the roots in a greater or less degree, and the injury thus sustained, will consequently act as a check in the progress of their developement. These considerations seem at once to mark the propriety of applying liquid manures in highly artificial cultivation; they can be supplied in this state, when the plants are in such a mature and advanced state of growth, as from time to time to require their aid; and their fertilizing properties being held in solution by the fluid medium in which they are conveyed, they are just in the condition to be taken up at once by the rootlets. It must still however be recollected, that whilst even impalpable powders cannot as such be made to minister to the nutrition of plants, so neither can gross liquids effect this purpose: it is clear limpid fluids, only, which can be received by the delicate spongioles, and therefore the so-called manure water, when applied of the consistency of mud, is not only in an unfit state to effect its purpose, except by the addition of a more bountiful supply of pure liquid, but it is also liable to act injuriously by reason of the concentration of the strength or powerful qualities of the manure, and by counteracting the open texture of the soil. Manure water, therefore, from whatever source it may be derived, though not necessarily a colourless, should without question, be a limpid fluid; if otherwise applied, it will at once destroy one of the best qualities a soil can possess, viz. porosity.

CHAP. VI.

ON THE APPLICATION OF MOISTURE.

From what has been stated in the preceeding chapter, it will be sufficiently evident, that a supply of water is required as a component of the soil, in which all plants are grown, in order to enable them to draw from it, other components, which form their food; and that, as it is necessary for them continually to take up a portion of this food, so is it necessary, that moisture should be continually present, in order to render it available by them.

Among other conditions to which the operation of applying water to the soil should be subjected, there are some which are specially important: it should never be either applied in *excess*, or unduly withheld; nor should it ever be applied when of a temperature below that of the atmosphere in which the plants to whose roots it is applied, are growing at the time of its application.

There is a liability of applying water in excess, when the particular stage of growth, the peculiar state of the weather, or the season of the year, are not duly regarded: thus, an adult plant will consume more water than an infant plant; and any plant, will decompose a larger quantity of water, in sunny weather, when evaporation is going on briskly, than in cloudy weather, when it is scarcely perceptible; again, in the summer season, a much larger quantity will be appropriated, than in the winter. Water has been applied in excess, whenever the soil becomes soddened or saturated therewith; but great as this evil is, it is equalled in its injurious effects, by falling into the opposite extreme, and withholding a quantity sufficient to render the constituents of the soil, available as food to the roots of plants placed in it.

The necessity of applying water, of a temperature equal to that of the soil, is rendered evident by a reference to the natural conditions by which the soil is watered. In a small and nearly globular form, the water gathered up by the action of the sun, and forming the clouds above us, is precipitated through the atmosphere, and there its temperature becomes equalized or assimilated with that of the medium through which it has been passing; and although in our own latitude, we perhaps fail to discover any material degree of warmth in the drops of rain as they fall, yet in eastern climes, we cannot but imagine, that after having been submitted in the thin strata of the clouds to the action of the sun, they must previously to entering the soil, have imbibed some portion of heat. Moreover, the importance of maintaining a gentle bottom heat, at the roots of forced plants, renders it necessary to avoid any application, which may tend to lessen its effect, and submit the roots to any chilling influence. The temperature of the soil is naturally above that of the atmosphere, and as the application of moisture by exciting evaporation, has an abstract tendency to lower the temperature, it should therefore, when applied, be in a slight degree warmed, so as thus to increase rather than diminish the heat contained in the soil.

As some moisture in the soil is necessary to render the food contained therein, soluble, and available to the spongioles of the roots, so moisture in the atmosphere is essentially necessary to assist in applying the gaseous elements of that elastic compound fluid, to the nutrition of plants by the action of the leaves: without moisture in the atmosphere, the leaves and outer covering of plants would become dessicated, and the stomatas shrivelled up and closed, so that neither the exhaling nor the imbibing functions of the plants could then be carried on.

The moisture of the atmosphere, then must not be neglected; not only because the healthy action of the vital organs of the plants depends on a proper hygrometrical state of the atmosphere, but, inasmuch as it is the readiest means both of avoiding, and when unhappily, they are present, of destroying, many of the most destructive and troublesome insect enemies, to whose depredations, plants are subject.

When a moist atmosphere is duly and regularly maintained, there is but little fear need be entertained of the establishment of a colony of insects—such as the thrip, and the red spider, which are perhaps the greatest pests which have to be overcome in the forcing house; nor is there a more effectual method of destroying them, than by applying a high temperature in conjunction with an intense degree of moisture. To the want of a balance of moisture in the composition of the atmosphere, and in the soil, too, rather than as is commonly supposed, to an excess of it in the former, is the appearance called mildew to be attributed; this it occasions by checking the regular action of the perspiratory organs, and thereby inducing an eruption of the cells of the tissue: the extravasated sap lodging on the cuticle, affords a nidus for the germination of the sporules of that particular fungus, which when grown, is the mildew: the remedy consists in avoiding an irregular composition of the atmosphere, as regards heat and moisture; and also an excess or deficiency of moisture in the soil, so that each may be in a condition to exert its proper influence on the constitution and developement of the plants. Canker, another disease, to which Cucumbers are sometimes subject, appears to be produced by too low a degree of temperature, accompanied by an excess of moisture, both in the soil and the atmosphere, and it generally attacks those particular parts, where any check or obstruction is offered to the flow of the sap, such as that occasioned by a wound, or

even the ramifications of the stem: this suggests that its remedy, would consist in a due regulation and balance of the constituents of the atmosphere, and the soil.

Moisture is generally applied to the soil by being poured directly on it, and to the atmosphere, by means of the syringe, and the use of evaporation troughs. When applied to the soil only from the upper surface, there is a liability of its failing thoroughly to moisten it, and by reason of this, together with the constant action of the heat from below, by whatever means heat may be applied, the soil is frequently found to be dry beneath, when the appearance of the surface might lead to the supposition that it was sufficiently moistened.

By a reference to the sketch and description already given, it will be seen, that a provision is there made, whereby water can be poured in quantity *beneath the soil*, immediately on the top of the tank, whence in the form of vapour it will rise among the soil, and thus render it thoroughly moist; at the same time, it can be applied to the surface, whenever it may become necessary to do so. The moistening of the atmosphere will also be fully secured by the mode of ventilation which is there proposed, for the air, at the same time that it is warmed, will become charged with moisture in a ratio equal to its temperature, before it enters the house. If it becomes requisite to admit moisture without changing the volume of air, it can readily be effected by opening the tubes or shafts inside the house, without opening the exterior ventilators; and when dry heat may be required, it can be secured by closing entirely the communication with this reservoir of moisture, and the hot-water pipes will then radiate any quantity of dry heat that may be required.

By means of a due application of these provisions, an equable degree of moisture beneath and among the soil, as well as in the composition of the atmosphere, can be secured with perfect ease, and a trifling amount of labour.

CHAP. VII.

ON THE REGULATION OF THE TEMPERATURE.

If we figure to our minds, a plant which in its native habitat enjoys a climate far more genial, and a temperature far more elevated, than our own country affords, it must be obvious that some regulation, and increase of temperature, either positively, by the artificial application of heat, or negatively, by affording shelter and protection, will be required in order to ensure any degree of success in its cultivation. The Cucumber is a reputed native of the East, and we have therefore in this supposed fact, an indication of the nature of the climate, which it should be our object to provide for it; but still it must be borne in mind, that in conducting any system of artificial cultivation, it is not at all times desirable, or even safe, to supply a resemblance to any part of the natural circumstances affecting the growth of a particular plant, unless we have the means of supplying the *greater part*, or *all* the conditions which exist in a state of nature: this I shall again have occasion to refer to.

By another step we arrive at the conclusion that the standard of temperature, to which the Cucumber is submitted in its cultivation in this country, is a point, varying with the individual opinion of cultivators; as some may take a part of the natural conditions of growth as their rule; others, all these circumstances; and others, again, various combinations of them.

Referring back again to the provisions of nature, we can scarcely hesitate to conclude, that in clear sunny weather, the temperature to which the Cucumber is sub-

mitted, *cannot within reasonable limits*, be permitted to rise too high; whilst at other times, when the weather is dull, or cloudy, and always at night, a much lower degree of heat ought to be applied. In sunny weather, the natural agents which cause excitement and activity of the vital functions, are in full action; and consequently at such periods we may rationally indulge in the application of those exciting agents which are under our controul—always however bearing in mind, that we must not unduly apply one agent, when we either cannot, or neglect to apply the others also. On the other hand, in dull weather, and at night, the source of light being in the one case absent, in the other obscured, a comparative state of lethargy or repose is prevalent, and the natural functions of vitality are but feeble in their action, if not in some cases, absolutely in a quiescent state; with such a state of things existing, it is barely rational to apply stimulants, and to induce unnatural excitement. The application of exciting and stimulating agents at such periods, may be compared in its effects to the excitement of a frightful dream acting on the human frame; the vital functions—not the vitality itself—cease during sleep, and both the animal and the vegetable should be at rest; excitement acts on both by deranging the system, at least for a time, and since a succession of these derangements are known to produce injurious results, we may be certain, that each separate instance must have an evil tendency.

In applying this practically, to the case before us, it may be recommended, that the temperature in which Cucumbers are grown during winter, should not fall much below 60° Fahrenheit, at night; and in the day time it should not rise above 70° in dull weather, by the aid of heat artificially applied; in clear weather, by the influence of that glorious source of light and heat, the sun, it may be safely allowed to rise to 80°, or a little higher,

before air is admitted. A somewhat higher range may be permitted, as the days lengthen, and the influence of the sun becomes more powerful; thus at night, it should not rise over 65° , by day 75° to 80° , and by sun heat to 90° . Thus it will be seen, that I have recommended the regulation of the temperature of the internal atmosphere, by that which is external; and it is my firm conviction that inattention to this simple rule, is the source of much of the failure, which is experienced by some of those who attempt the growth of plants, at any other than that, which may be regarded as their natural season of growth. It appears to me, most unreasonable, to aim at attaining any particular point of the thermometer, merely because any particular season of the year may be present, or any particular stage of growth attained. Even if in the sunny climes, from whence the Cucumber has been transmitted to us, there exists such an equality of temperature and atmospheric serenity, as some cultivators attempt in the growth of these plants; it surely cannot be consistent in us to equalize and elevate the temperature of our artificial atmospheres, when we cannot supply them at the same time with the same intensity of light, or provide for them the same serene and unclouded sky. It should rather be our object to adapt the plant to the climate of our country, since we cannot change the climate to supply the natural circumstances, with which the plant is favoured; and acting on this principle, we should never aim at supplying the agents which would induce a premature and therefore debilitated development, when the whistling wind, and the drifting snow, tell us that Nature, would have, at least the members of her vegetable kingdom, be at rest.

Since however, it is apparent that during the depth of the winter season, at least when wintry weather is present, the progress of plants in an artificially heated atmosphere, ought not to be rapid, or unduly forced; it by no means

follows that no progression at all should be made: the elements of growth may be supplied; but the application of them should be guided by moderation, being lessened at those particular periods when the weather is least propitious, and increased during those periods when it is most favourable. In the works of Nature we may ever learn a lesson of consistency, for they are perfect: they teach us that food is requisite to maintain the life of all those objects which are endowed with it; that that food must undergo a process both of digestion and assimilation, ere its purpose is fulfilled; and that each of these processes depend on the action of natural agents. In the vegetable kingdom, heat and light as derived from a united source, are the agents appointed to bring about these results, and in order to ensure their proper action, they must both be present in a powerful degree: in artificial schemes of culture, we can command a supply of the one, but the other is not within our power; our consistency therefore depends on our applying so much of the one under our controul, as will secure the united action of it, with the existing degree of the other—consequently, *when light is absent, or deficient, heat should also be diminished; and when light is present and abundant, heat may safely be increased.*

CHAP. VIII.

ON THE ADMISSION OF AIR.

The question of the admission of air, is one of some importance. It is an opinion, which was I believe first publicly brought forward by the late Mr. Knight, that an influx of a large volume of the external atmosphere, to the interior of forcing houses, is by no means requisite, and is often the source of very serious evils. Were it for no other reason, than that of avoiding the chilling influence of cold air on the tender tissue of plants growing in a high temperature, I should feel inclined to support such a view; but when there are facts sufficiently abundant, to prove, that plants do not themselves vitiate the air of such structures to an extent sufficient to render it unfit for their continued growth, or at least, that a sufficient interchange is constantly going on, without opening the sashes of a forcing house, the evidence appears to be overwhelming; and the necessity of continuing a practice so fraught with danger, and so frequently attended with disappointment, appears to be done away.

The injury done to the tender foliage of plants in forcing houses, by contact with cold air, results from the increased capacity of air for moisture, as it become heated. When cold air is admitted to these structures, it cannot contain so great a quantity of aqueous matter, as it is capable of taking up when it becomes warmed: this increase of temperature, is soon in great measure, supplied to it, but rarely is a sufficient quantity of moisture, at the same time within its reach, to enable it to supply its increased capacity for aqueous matter: the consequence is, that on coming in contact with the foilage of the plants, which is of a succulent nature, and contains a great proportion of water, the warmed air continues to abstract a portion of

moisture from the plants, until its capacity is satisfied; and hence the plants are robbed of their "life's blood." Besides this action, which is the cause of serious evil, the tissue itself is contracted and thereby injured, by reason of the degree of cold, which is at the first gush, liable to come in contact with the warm foliage. These remarks apply to cold air, when admitted in a large bulk, by opening the sashes; and when a draught is produced, by opening them, both at the back and front, and the top and bottom of the house.

Deterioration of the air, by the action of the functions of the plants, could not take place, except in hermetically sealed structures: for by reason of the expansibility and elasticity of air, when it becomes at all heated, it not only gains egress, but also admission through the most minute crevices: that this interchange is sufficient to counteract any deteriorating influence which the plants might have on the internal air, with respect to their continued existence in it, is abundantly proved by the growth of plants in Ward's cases, from the interior of which the external air is excluded as fully as it possibly can be, without their being actually sealed: if therefore, any injurious effects result to plants, from their being cultivated in a close atmosphere, we must seek for the cause, in some other source, than the plants themselves. If any noxious qualities exist in the atmosphere of structures, to which the external air has not free ingress, they must result from some neglect or ignorance on our part, in suffering extraneous and unwholesome matters to accumulate in such situations, and there to decompose, and enter into combination with those gaseous bodies, which form the volume of the internal atmosphere of our plant structures. The existence of such extraneous matters, may indeed be traced to various sources; and they may be present, even when much vigilance is employed to prevent their accumulation; and therefore, as an inconceivably minute quantity,

inappreciable to the senses, would frequently be sufficient to effect deterioration, it is possible that these impurities may often originate in sources which are least of all suspected. The decomposition of organic matter, whether animal or vegetable, may frequently be the source of injurious results in this respect; for although this is principally resolved into those elementary gases, which appear to form the basis of all created objects, yet there are other matters liberated, which may then enter into fresh combinations; and either this, or a disproportionate accumulation, even of these elementary bodies, may reasonably give rise to serious apprehension, and demand the exercise of discretion, in order to prevent them from becoming injurious. Besides this, these decomposing bodies, afford just the very state of things, which appears to be requisite to call into existence, and developement, a numerous phalanx of cryptogamic vegetables: not that such matters, can for a moment be rationally considered to generate, these *cellulares*; but that they afford a suitable pabulum, and medium of developement for those millions upon millions of sporules, which we may readily conceive to be dispersed in the atmosphere; and with which it may be teeming, though from their buoyancy and minuteness, they may float to us invisibly therein.

The admission of the external air, by the ordinary process of opening the sashes of forcing houses, has been said to be unnecessary, or at least by no means important, in so far as the function of vegetable respiration is concerned, because the buoyancy of the air within all such structures, would enable it to escape in sufficient quantity through their openings and crevices, to counterbalance any thing like deterioration, which might by any means result from the vital action of the plant. The admission of external air, is also directly injurious to forced plants, during the winter and spring months, when a very material difference of temperature exists between it, and

the internal volume, by contracting the vessels, impeding the circulation of the juices, and thereby checking the regular course of the growth of the plant. If these reasons fail to stamp it as a practice which ought not largely to be indulged in, it is further objectionable, as being productive of a prodigal expenditure of fuel: there can be little doubt but that generally speaking, a far greater quantity of fuel than is requisite, is expended in maintaining the temperature of forcing houses, solely from this cause; for the cold air when admitted, continues to abstract a portion of heat from the warmed air, until the temperature of both becomes equal, and consequently an increased application of fuel is requisite, in order to raise the newly admitted air to the same temperature as that which has been suffered to escape; and as the buoyancy of heated air is so great, an immense volume must necessarily rush out through a very small aperture, and thus there must also of necessity be an immense waste both of heat, and of fuel. A given portion of fuel, in its combustion, can give off but a certain proportionate ratio of heat, and if this is allowed unnecessarily to escape, the prodigality is self-evident. It is but a weak argument, which would seek to give to the admission of cold air, the office of regulating the temperature of plant houses; this ought to be effected by limiting the degree of heat *applied*, and not by attending to the *abstraction* of that which had been previously administered with too lavish an hand. Besides the extravagance of such a course, the constitutional vigour and energy of the plants is at the same time sacrificed by undue excitement. The admission of cold air in large quantities, therefore, brings condemnation in its train, since it is unnecessary, and extravagant, as well as directly injurious.

There are nevertheless some considerations which render the admission of air, when regulated and applied with discretion, an operation of importance to the health of

plants: it is productive of beneficial effects in carrying off the noxious vapours, which *may* although unseen, and guarded against, still float in the atmosphere; and there can be little doubt that another beneficial influence which it exercises, results from the motion which is produced by a body of air changing its position, which probably promotes circulation, and increases the excitability of the plants.

Since therefore a change of the volume of the atmosphere in plant houses, is productive of benefit, and the admission of a large body of cold air, is at the same time so decidedly objectionable, it is important, that in endeavouring to secure the benefits of the practice, the injuries which are liable to result, should if possible be avoided. The regulation for the admision of air, which is described in the second chapter of this treatise, may be regarded as being of some importance in this respect, as well as in the provision which it includes, of supplying the heated air, with a due proportion of moisture.

Physiologists tell us, that plants derive a considerable proportion of their food, directly from the atmosphere, by a process similar to the inhaling of animals; and that the substances thus derived, are carbonic acid, ammonia, and water, which contain the elements of organic matter in considerable proportions. The influence of the atmosphere is exerted beneficially, by its constituents entering into combinations with other matters, which are taken into the system by the roots, and spread out and exposed in the leaves: this exposure has so far the effect of altering the character of the substance carried up from the roots, that it is no longer a body of crude juice, but is undergoing a process of elaboration, and is being assimilated with the superincumbent tissue of the plant. There seems to be no reason why those particular gaseous bodies which plants appropriate to themselves from the atmosphere, should not to a great extent be supplied to

them artificially, at such periods as it may be necessary, or desirable, to accelerate their growth, and induce a more perfect and mature developement. It has been already stated, that the most important of these aeriform bodies, are nitrogen, which plants derive from ammonia; and carbon, which they derive from carbonic acid gas, on the liberation of the oxygen, which is one of its constituents; neither of these, can however be appropriiated, when in a free state, but only when in a state of combination, and forming either a gaseous or a fluid body. It is probable that nitrogen might be supplied to plants, through the medium of the atmosphere in an artificial manner, by placing within any structure, a portion of some of the volatile salts of ammonia, which latter being given off, would at once supply the demands of vegetation. Carbon might be applied, by the use of charcoal; and it is worthy of experiment how far the *combustion of charcoal*, in plant structures, by accelerating the formation of carbonic acid gas, may have a beneficial influence on vegetation. The use of charcoal as an ingredient in the soil, though doubtless partly, and perhaps principally mechanical, is nevertheless in all probability rendered advantageous in this very way; the slowness of its decomposition must however render the quantity applied, very homœopathic in its nature.

A series of experiments with the view of ascertaining the practicability of continually supplying to the atmosphere, those qualities which plants abstract from it, and of determining the manner, and the degree in which they should be applied, would be one of the most interesting and important matters, to which the minds of Horticultural reformers could possibly be directed; but it is most essential, to remember, at the same time, “that these are powerful agents, requiring much skill in their adaptation,” and capable of effecting serious injury and disappointment, if indiscriminately applied.

CHAP. IX.

ON THE GROWTH OF MELONS.

~~~~~

It is barely possible to suppose any use to which a structure which during the winter season had been devoted to the growth of Cucumbers, could be so legitimately appropriated in the summer, as that of the growth of the finer Melons of Persia, Cashmere, and the East. The superiority of such as these, in every point of view, over those kinds, which have been long in cultivation, would be an ample recompense for the appropriation of such valuable space to their use; whilst in no other structure could the peculiarities of the treatment they require, be so fully complied with, and be rendered so completely under controul, as in that under consideration.

There are some peculiarities in the treatment of these Melons, to the consideration of which, it may be desirable to devote a brief space; the most important of these, are the composition of the soil, the application of moisture at the root, the regulation of atmospheric warmth, and also, of atmospheric moisture; in these particulars, they offer some differences to what has been previously stated, with reference to the Cucumber.

The soil in which the Melon delights to grow, is one of a more compact texture than is usually regarded as applicable for the Cucumber: a suitable compost consists of the "top spit" from a loamy pasture, of a texture *rather adhesive*, and retaining the herbage and roots of the grass; this should be collected a few months before it is used, so that these vegetable substances may be in a *decaying* state, and it should be broken roughly to pieces, but by no means sifted; to it, should be added,

about one-fourth part of vegetable mould : the whole should be well incorporated, and, before using, should be placed in a situation where it may not be liable to become saturated by heavy rain ; which would serve to destroy the free and open texture, which it is so desirable to retain.

In the application of moisture to the soil, the structure which is described in a previous chapter, will be found to present facilities, which peculiarly adapt it for the growth of these plants. In Persia, and the neighbouring countries, where the Melon is so successfully grown, the ground is irrigated by means of numerous channels, which, from the limitation of their exposed surface, are not peculiarly adapted to supply atmospheric moisture ; but are yet sufficiently numerous to secure the perfect irrigation of the soil, within the reach of the roots. The tubes or shafts, represented at (*n*) in the sketch referred to above, are intended to communicate directly with a layer of coarse open material, extending entirely over the top of the tank, and beneath the soil ; by means of these a supply of water should be poured beneath the soil, which will thus keep that portion immediately about the young roots, in a constant and complete state of saturation, by means of the steam which will arise, in consequence of the heat from the tank. A uniformly warm, and a thoroughly moist soil, will be thus easily secured, which are two important points in the growth of Persian Melons. It must be recollected that these conditions for supplying moisture, are recommended only during the time of growing the plants, and swelling the fruit ; but as these latter approach their maturity, the degree of moisture must of course be gradually diminished.

In connection with this moistened and genial soil,



the Melon has naturally the advantage also, of powerful sun heat, and intense light ; and these are two conditions which it is indispensable should be supplied in artificial cultivation, as fully as they can possibly be obtained. It is by means of the moisture of the soil, that the plants are enabled to grow on rapidly and vigorously, because that moisture renders the food contained in the soil, soluble, and therefore available to the roots ; but the elaboration and assimilation of this food depends on the degree of *light* and *heat* with which they are supplied : without these conditions, to convert the crude sap, by their united agency, into organic compounds, such as lignin, gum, starch, and sugar, and to induce their deposition, the fruit will indeed be formed—it will grow, and perhaps may even tempt the eye ; but unless these chemical and vital changes have taken place in its constituent parts, the eye, as it frequently happens, will have been deceived ; and instead of the palate being gratified by a mature and luscious fruit, it will find nothing but a tasteless mass of pulp. The plants, therefore, cannot, in our latitude, receive too intense a degree of solar heat, or of light.

The same cause which renders the natural atmosphere of the Melon countries elevated in temperature, renders it also comparatively dry ; the sun drinks up the moisture which is deposited near the surface, or which may rise to that position ; and by an exceedingly powerful influence effectually prevents the accumulation of moisture about the exposed parts of the plants. The atmosphere is nevertheless not in an arid state ; the evaporation from a well-moistened soil effectually prevents this from being the case, but the excessive heat also as effectually and continually prevents an undue accumulation of moisture in the atmosphere.



The application of this fact, to artificial practice, is plain ; a less amount of moisture artificially applied, in comparison with the temperature, must be permitted, than when the cultivation of those plants is attempted whose natural habitats are less strongly featured in this respect.

Such considerations as these naturally force on us the conclusion, that it is vain to attempt the cultivation of this noble fruit, except during that portion of the year when the sun exerts his greatest power in our latitude. It is not because they cannot be induced to grow at any other period of the year, for the mere extension of vegetable tissue will go on, though the influence of the natural agents is but limited and feeble ; but it is because maturity, perfect development, and, above all, the full assimilation of the sap, cannot take place sufficiently to ensure a good flavour in the fruit, except light and heat are not only unimpeded and constant, but powerful and united in their action.

---

## CHAP. X.

### CONCLUDING REMARKS.

---

I will here briefly recall attention to a most important point which the cultivator should continually keep in view: it is most important that he should *study Nature* ; for if we may believe our senses, or place any confidence in overwhelming evidence, we may be certain that all the conditions we observe in a natural state of things, have been planned by an All-wise hand ; and further, that a finite mind can never attempt with suc-

cess, either to surpass or to dispense with any portion of that which an infinite being has ordained. "Order is Heaven's first law," and in whatever we may attempt to do, we shall not be wise, if we endeavour to effect our purpose by any means which may distort the fair proportions which unaided nature presents to our view. In cultivating plants, therefore, we should administer the conditions which are favourable to their growth and development, in somewhat the same proportions each to the other, in which they are naturally blended—not supplying one essential, in an undue manner, and, at the same time, neglecting others; for successful cultivation must ever depend upon the connection and influence of numerous circumstances upon each other, and can never be attained, unless these conditions are complied with, either designedly, or, as it often happens, by mere accident.

Another point which it is important to keep in view, is that instructions should be studied, rather than copied, in their application to practice. No instructions can be given that should be blindly and implicitly followed. The circumstances under which plants are placed are varying every day, and even every hour, and, to be successful, horticultural practice must be varied also. It must, however, be varied according to principle. But even what are regarded as established laws and principles should not be heedlessly followed; to be truly successful, a man must not only be a practical enthusiast and a keen theorist; he must also be a skilful experimentalist: his experiments and their results, if carefully watched, deduced, recorded, and studied, will serve to guide him for the future.

## APPENDIX.

---

### *On Heating, Ventilating or Aerating, and Covering.*

Since the publication of the first edition of this work in 1844, the views expressed in the second chapter, with reference to structures best adapted for Cucumber culture in the winter season, have met with much corroborative support. Respecting the questions of heating, ventilation, and covering, a few more words may be added.

I have before recommended hot water tanks for supplying bottom heat, with attached pipes for the circulation of hot water to warm the atmosphere. I can see no reason for recommending any other arrangement now ; for the experience of successive years goes to show that hot water, applied on sound principles, is, above all other means of heating, effective in its operation ; and as to the question of expense, raised as an objection to it by some, it is sufficient to say, that, although one hot water apparatus may be fitted up in an expensive manner, another may be rendered perfectly successful in its operation, at the same time that it is extremely simple in its arrangements, and correspondingly inexpensive in its cost.

A seeming error in the engraving, at p. 18, has been pointed out to me. In the description of the sketch it is stated that, "a series of pipes attached to the same boiler [which heats the tank] would supply the requisite heat to the atmosphere." The sketch itself shows these pipes to be considerably above the level of the water in the tank, and where they could not, consistently with the other arrangements, be thus



employed. This may be explained thus :—the sketch was introduced rather for the purpose of illustrating certain proposed arrangements, as regards bottom heat and ventilation, than as furnishing an exact and detailed design for a model structure ; and thus it happened that the pipes were merely shown to be placed at the front part of the house, to indicate that this was their proper relative position. There would be no practical difficulty in placing the pipes lower down, and nearly close to the front wall, so as to admit of the proposed connection ; all that would be required to effect this, being to fix the slab, on which they rest—and which prevents the air from rushing upwards into the atmosphere of the house at this point—in a sloping position, instead of a horizontal one.

The principle involved in the plan proposed for aëration or ventilation, is no doubt a sound one ; and though the plan which is more particularly described may be modified and varied, yet it is believed to be efficient for its intended purpose.

There can be no doubt that the admission of cold air to a structure in which tender plants are being forced, either during winter or early spring, is materially hurtful to the plants, in proportion to the tenderness of their constitution ; and the Cucumber being, under those circumstances, a plant of a very tender and delicate nature, is especially susceptible of harm from this source. As a consequence resulting from this fact, there can be little hesitation in affirming that whatever fresh or external air it may be necessary to admit, during the period referred to, should be warmed before it reaches the plants, and in being warmed not burned, but supplied with the additional moisture its increased heat capacitates it to take up, and which, to be congenial to vegetation, it requires. This is provided for



by the plan already recommended, where the cold air is made to pass through the tank containing the heated water which warms the soil. By a perfectly practicable modification of this arrangement, not only may this result be secured, but also the continual circulation of the internal atmosphere may at pleasure be assisted and accelerated, during the time when it might not be necessary to admit fresh air. This would be an additional advantage. The arrangement proposed to effect this, is to conduct the cold external air through a heated chamber containing the tanks—these latter being covered, but also admitting of being opened to any extent to supply moisture or steam in the proportion required. The cold air, after passing upwards through the chamber, escapes at the front of the house, and ascends to the upper part of the house, from whence it finds its way downwards near the back wall, and there again enters the chamber, through openings provided for the purpose. The circulation of the internal atmosphere would be thus facilitated and accelerated, even without the admission of any current of external air, for, of course, there is more or less of this kind of movement going on in the atmosphere, wherever and in whatever form a source of artificial heat is present. Another mode of combining internal atmospheric motion, with ventilation, and by which the cold air is warmed before it reaches the plants, has been practised with very marked success, in a vinery at Park-hill, Streatham, Surrey; and I have described it in the *Journal of the Horticultural Society*\* as follows:—“This plan consists in passing a zinc pipe, thickly perforated with small holes, from end to end of the vinery, and exactly beneath the range of hot water pipes, which heat the structure. In the outer [end]

\* The Journal of the Horticultural Society of London, vol. I. p. 114.

wall, communicating with this perforated pipe by means of a kind of broad funnel, a register valve is fixed, by which the admission of air can be regulated with the utmost nicety, or the supply be shut off altogether : this valve is fixed a little below the level of the perforated pipe. The action of this contrivance was evident enough from the motion communicated to the foliage of the vines ; and its effects were apparent in the unusually healthy and vigorous appearance they bore, until their period of ripening. In this case, sufficient moisture was kept up by syringing the walls and pipes, wetting the pathway, and by the use of evaporating troughs, placed on the metal pipes, and kept constantly filled with water."

In another communication published in the work already quoted,† after alluding to the now well-known garden truism, that a comparatively low night temperature is indispensable to the maintenance of vigorous growth in plants of all kinds, I have advocated a more extended adoption of the practice of night covering hot houses, as a means of permitting the low night temperature required, and at the same time securing the plants against the extreme cold to which they would thus be sometimes liable. From the changeable nature of our climate, there is some difficulty in apportioning the degree of applied heat, so as to suit exactly the requirements of the plants in these respects ; and it is especially difficult to maintain with certainty the low degree of night temperature which would be desirable, and at the same time avoid risking the safety of the plants, through a sudden declension of the temperature of the exterior air. At present this difficulty has to be met by extraordinary care on the part of the gardener, and often by serious encroachments on his

† *Ib.* vol. 11. p. 29.

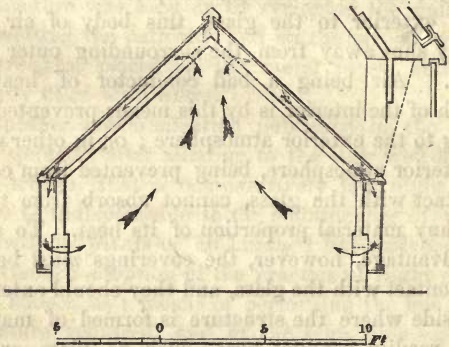
proper time for study and for rest: even then sometimes without success. This end would be much more effectually and certainly secured by a *complete system* of covering hot-houses and forcing-houses; and this plan would secure the further advantage of avoiding the undue stimulation of the plants by a then unnecessary amount of heat, applied solely to prevent the very evil which covering also prevents, namely, the risk of excessive cold during the night.

The principle upon which a covering acts most efficiently, is that of enclosing a complete body or stratum of air exterior to the glass, this body of air being entirely shut away from the surrounding outer atmosphere. Air being a bad conductor of heat, the warmth of the interior is by this means prevented from passing to the exterior atmosphere; or, in other words, the exterior atmosphere, being prevented from coming in contact with the glass, cannot absorb from the interior any material proportion of its heat. To secure this advantage, however, the coverings *must* be kept from contact with the glass, and they should extend on every side where the structure is formed of materials which readily conduct heat—such as glass or iron. The coverings should in fact form neither more nor less than a *close outer case*.

One point connected with the application of these coverings, which I consider would constitute an improvement, and which, as far as I am aware, has never been acted on, is that of having them to fit so accurately as to exclude the external air (a matter of no difficulty in the degree required), and then to have a series of ventilators provided, to stand open during the night, whereby an interchange of the atmospheric volume would take place throughout the night, without exposing the plants to contact with cold air. The



stagnation of the internal atmosphere would thus be prevented, in consequence of the interior air and the air between the glass and the covering being of different degrees of density, owing to their being differently charged with heat. By this plan, therefore, I conceive that direct benefit would accrue to the plants ; and it would also materially assist in preserving that cooler—but not cold—night temperature, which the fear of injury from frost prevents from being more fully realised in ordinary cases.



The annexed diagram represents one of the many ways in which this idea might be carried into practice. It will be understood that, as here shown, the side shutters and end shutters (the latter not indicated), fit into grooves, the upper groove being attached to iron pins, and thus fixed at a proper distance from the building, without obstructing the passage of air along the enclosed space ; and that on the lower side being so fixed as to exclude the external air in that direction. The top or roof shutters also run into a groove along the ridge of the roof, and at the lower end fix close down to the top of the side shutters, fastening with a



button. Each of the shutters should have a projecting fillet fixed on one side, so as to shut close over the adjoining one. The shutters themselves should of course be made of light frame-work, strengthened where necessary, with small iron rods. The material used for covering them may be the asphalte felt, now manufactured extensively for roofing purposes, or strong brown paper, coated with tar; the latter is used extensively in Germany for this purpose, and is found to be very durable and cheap; it is there even preferred to every other material.

Though the covering of hot-houses has been already practised in some cases, I am not aware of any one having adopted a close covering with the view to facilitate ventilation or aëration during the night. It appears to me that the circulation of air, secured by the means here proposed, would have much influence in excluding cold, whilst at the same time it would prevent the interior from becoming too warm and close.

### *On Transplanting and the use of Turf Pots.*

I have, at p. 26, given what appear to me to be some of the principal reasons against the practice of transplanting, or planting out, Cucumber and other plants. When this is done after any quantity of roots are produced, some injury or check must be sustained during the process; and checks of this kind are opposed to the realisation of the greatest results within the shortest period, which of course is the great object in view. Where it is inconvenient to plant the seeds in the places the plants are intended to occupy, or to put out the young plants during the earliest period of their development, or where propagation by cuttings or layers, is adopted, and the plants of course have to be potted separately, so as to be in a removable state,

the following simple plan may be adopted, and will be found to combine all the advantages and conveniences attending the use of pots, with the avoidance of the evils of transplantation, &c. The plan referred to, consists in the employment of turf or peat, so contrived as to supply the place of pots, and which of course at the time of planting is simply placed, along with the plant it contains, at once into the soil, without in the least disturbing the roots, which, growing through the substance of the turf, extend beyond it in all directions into the free soil provided for them. These turf pots are made of spongy, fibrous turf—whether loamy or peaty is not material, provided it is full of fibre, so as to admit of being readily traversed by the roots. The grassy surface is evenly removed, and the under-turves are cut three or four inches in thickness, and are then divided into squares of about three inches across. The centre of each of these little squares is taken out by means of an iron scoop, such as that represented in the annexed sketch; and this is



then filled up with soil, and the plant, or seed, or cutting, or layer, inserted as if it were into an ordinary flower pot. It will be obvious that by this plan, every plant is independent and perfectly removable—thus securing the convenience of sowing or planting and rearing the plants in pots during their earliest stages: on the other hand, at the time of planting out permanently, the plant, turf, and all being set carefully into the soil, no check is sustained, because the roots remain undisturbed, and may, as they advance, penetrate through the turf into the prepared soil which surrounds them; in this way the advantages of sowing

or planting at the very first in the position the plants are intended to occupy permanently, are secured.

This plan of sowing seeds, or of planting young plants intended for transplantation, into pots made of turf, is not only applicable to cucumbers, but might be very extensively adopted in the case of annuals and half hardy plants raised in frames, during the spring, in large quantities for the flower garden. In these cases, however, as the quantity that could be reared within a given space would be an object, the turves should be as small as possible in their lateral dimensions—a bore of two inches and a half, with half an inch on each side, thus making the diameter three inches and a half, would be found convenient in this respect. For cucumbers, however, or when the plan was applied to any special object, a larger size might be employed, which would allow of the plants attaining a larger size before it would be necessary to place them in their permanent positions.

### *On Watering the Soil.*

In the diagram at p. 18, and the description of it at p. 20, I have indicated and recommended a plan of moistening the soil by pouring water down beneath the soil: this was to be done by the help of tubes provided for the purpose. The soil was supposed to rest on the top of the hot water-tank, which was to supply bottom heat; and immediately beneath the soil, a layer of open rubble was proposed to be placed, among which the water applied might find its way, and gradually moisten the superincumbent soil. Mr. Hunter, gardener at Mawley Hall, in detailing\* his sixteen years'

\* Gardener's Journal, 1847, p. 339.



experience in tank-heating, has in great measure corroborated these views ; and as his corroboration of the plan I have recommended, embodies some useful hints, I will quote the substance of his remarks :—"I had a pit erected, thirty-eight feet long, seven and a half wide, divided into four compartments, for growing melons and cucumbers, with a tank extending the whole length of the pit, six feet wide and six inches deep. Across this I put larch spars, and upon them turves, with the grassy side downwards, and on them the soil for the melons and cucumbers. The plants grew and did well for a time, but they were of short duration in comparison with the dung-bed. Instead of the moisture ascending through the soil as I expected, I found that the heat from the tank dried the turves and soil next to them as dry as dust, and that there was no such thing as obtaining a moist heat from hot water without the soil was in contact with it. Next year I put broken stones upon the spars, and turves upon them, and made my arrangements so that I could occasionally run water in the tank to wet the turves and the soil next them. This was an improvement ; and I went on prosperously for some years, till the spars began to decay. I then had iron bars put across, and two of the compartments covered with squares, a foot in diameter, and one inch thick ; the other two with slates ; both slates and squares jointed with Roman cement, to prevent the soil from getting into the tank, as I had found the inconvenience of it when using the spars. I put some broken stones upon the covers, and turves upon them, and then the soil. Here my original difficulty occurred ; the soil next the covers got too dry, and to moisten it from above was impracticable, without making the soil a complete puddle, which would have stopped the healthy growth of the



plants. To remedy this, I put six small earthen pipes into each division, the one end resting upon the tank covers, the other standing up above the soil. When I found by the watch sticks that the soil was getting dry, I poured water down the pipes through a tin funnel which I had made on purpose; this spread itself over the surface of the tank covers, and diffused a gentle moisture to the soil, so congenial to the growth of plants. This was a move in the right direction. I then thought that it would be better to pour the manure water down upon the tank covers, which I have done since. I found the broken stones over the tank covers troublesome; they were also a harbour for wood-lice. I now use only a layer of leaves next the covers, and they are cleared out with the soil."

### *On Atmospheric Humidity.*

Cucumbers cannot at any time be successfully grown in an arid atmosphere, although, during the winter season, they require a much less proportion of atmospheric humidity, than under the influence of longer days and brighter light; and conversely, the degree which would be necessary to secure their welfare in summer, would be fatal to them in winter. An experienced gardener would tell almost instinctively, at either season, whether a sufficient supply was present or not; but less experienced cultivators would need some index, or register, to guide them. Such an index is afforded by the hygrometer; but most of the kinds of hygrometers are delicate instruments, and hardly suited for garden use. What is needed in this case is, not an instrument which requires minute observations and calculations, but something that will at once indicate the atmospheric humidity as plainly as

the thermometer does the temperature, and which may be as easily read off and understood. Simmons' hygrometer, recently introduced to the notice of horticulturists, professes to supply this desideratum; and though, perhaps, not a sufficiently accurate instrument for purely scientific purposes, yet, as simply and clearly indicating what is at least an approximation to the existing degree of atmospheric humidity, it is to be regarded as a useful garden hygrometer. By it, the degree of dryness or humidity is indicated on a dial-plate, by means of a moveable arm resembling the hand of a clock. The dial-plate is marked off into degrees, expressing the amount of moisture in the air, between what is observed when the instrument is plunged in water on the one hand, and exposed to excessive dryness on the other. As my own experience of this instrument, though favourable to its use, is still but limited, I cannot do better than introduce here the following remarks of Mr. Beck, of Isleworth, a very successful cultivator of plants, and one who has had considerable experience in the use of these instruments. It will be observed that Mr. Beck's standard for the orchid-house will be about suitable for cucumbers.\* Mr. Beck observes,—“The skilful gardener, observing the pointer to advance with dryness and return with moisture, will soon form a standard for himself, by which to regulate his stove, greenhouse, &c.; still some general scale is desirable. Two conditions must be carefully observed:—1. The instrument must neither be hung in the sun, nor where it will be liable to get wetted or saturated. 2. It must not be subjected to greater heat than is suited to vegetable life. For the six months commencing with August and ending

\* Gardener's Chronicle 1847.

with January, 40 deg. in the morning, increasing to 60 deg. about noon, and declining again to 40 deg. at night, is about the right scale for the orchid-house; whilst a range from 50 deg. to 80 deg. would be suitable for both the stove and greenhouse in those months. In the other half year, February and July inclusive, 30 deg. to 40 deg., morning and evening, running up to 80 deg. in the middle of the day for the orchid-house; 40 deg. and 50 deg., and up to 70 deg. for the stove; and 50 deg. to 80 deg. for the greenhouse, will prove very suitable. The above scale is desirable, but I do not say it is always attainable. Ours is an uncertain climate; sometimes a dry east wind will almost parch us up; at other times a southerly one, with wet, will cause a superabundance, which will have to be corrected, possibly by a gentle fire, and a free admission of air. The alteration hereby effected in the atmosphere of the houses will soon be evidenced by the hygrometer, and mildew and fogging off be kept at a distance. Opposed to an excess of moisture in the dull months of the year, is the dryness consequent on the summer and autumnal sunshine. Then, during the heat of the days, the instrument will seem to have run wild. Throwing water on the floors of the houses, and every means of increasing the amount of moisture, seems but of little or temporary avail; Simmons will go up, spite of all, to 90 deg. or 100 deg., and none the worse either, for it is still a faithful indicator, and as sure as the day declines, and the heat of the sun is withdrawn, so will it come back to a suitable point, when the plants are watered and the floors are wetted for the night. Remembering then, the variableness of our climate, I candidly admit that I consider any precise directions of very little value. None can be given that shall be implicitly followed, or on which success



shall certainly attend. Horticultural practice should be made dependant upon ever-varying circumstances."

Mr. Belville, of the Royal Observatory, has constructed the following Table, from a series of observations made with Simmons' hygrometer in connexion with the dew point, as obtained by a Mason's hygrometer, or a dry and wet thermometer.

| Range<br>of Simmons'<br>Hygrometer. | Mean<br>Humidity of<br>the Air. |                                                                                                          |
|-------------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------|
| 20° to 30°                          | 1·00                            | Extreme saturation; air precipitates moisture at a fall of temperature.                                  |
| 30 .. 40                            | 0·96                            | } Ordinary fine dry weather.                                                                             |
| 40 .. 50                            | 0·89                            |                                                                                                          |
| 50 .. 60                            | 0·81                            |                                                                                                          |
| 60 .. 70                            | 0·77                            |                                                                                                          |
| 70 .. 80                            | 0·72                            |                                                                                                          |
| 80 .. 90                            | 0·67                            |                                                                                                          |
| 90 .. 100                           | 0·59                            | Air contains one half of the moisture it is capable of holding in solution; in England very dry weather. |
| 100 .. 120                          | 0·50                            |                                                                                                          |

Example:—Suppose hygrometer read 45°, the mean humidity corresponding is 93. Again, if hygrometer read 90°, the mean humidity corresponding is 59°.

### *Mushrooms.* (See p. 22.)

Convenience for growing mushrooms may always be planned in a cucumber house; and as these excellent fungi are universally approved, it may be useful to append an epitome of the mode in which they should be cultivated.

The best, or, at least, most convenient situation for the bed, would be beneath that provided for the cucumber plants (see p. 18). The front may be formed of two course of brick-on-edge, and if divisions are required, they should be formed in the same way. The bottom should be made even, and rendered dry. The material for forming the bed itself consists of short

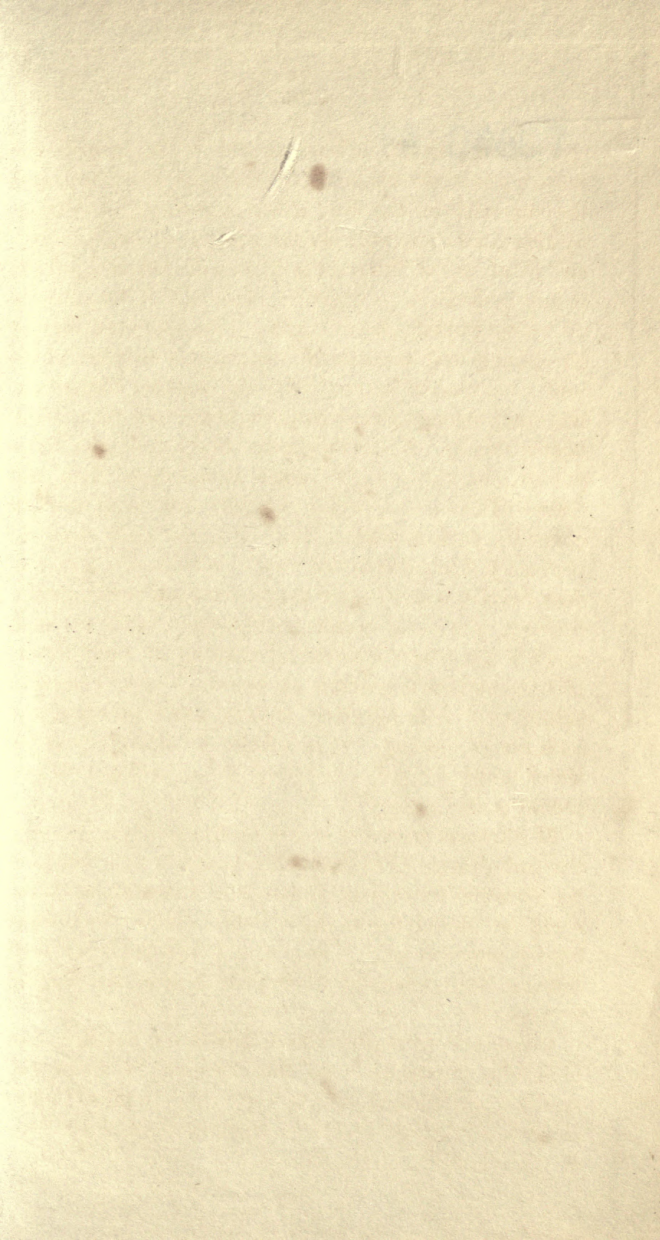


stable litter, with horse-droppings, but chiefly the latter, brought to a certain state of fermentation. The droppings and litter should be obtained daily from the stable, until enough for a bed is collected; it should, from day to day, be thrown up into a flattish heap, in a dry place, where it will ferment very slightly. As soon as enough is got together to begin to ferment, the heap must be turned over; and in these turnings, the outer and inner parts of the heap, as well as the fresh and the fermenting, must be well mixed up together; the heaps should be turned every second day, and should never be made large, or else the dung would become both too hot and too dry, either of which would spoil it. To avoid this, the heaps should be flat and shallow, with as much outside as possible; in this way the air, acting on a considerable portion of it, renders it rather dry, and checks too rapid fermentation. This preparation must be continued until the whole mass is brought to an uniform mild, dryish state of fermentation. Then the bed may be made in the following manner:—About three inches of the prepared dung is laid evenly over the bottom, and is beaten down firmly with a flat heavy wooden mallet. Another layer is then put on in the same way, and this is repeated until the bed is formed to a thickness of about six inches. The next two inches of the dung should have about a sixth part of light turfy loam reduced to mould, and sifted, mixed with it to give it body. The bed is now prepared, and is to be spawned as soon as it is seen that it does not heat violently. The heat ought not to exceed 90 degrees: if it reaches higher than this, holes must be made, a few inches apart, to let the heat pass off, and in a day or two these may be filled up again. The spawn is to be put in when the heat ranges about 75 degrees; lumps of spawn about as large as a small

egg may be used; a hole should be made with the fingers about two inches deep, the spawn inserted, and the material of the bed closed about it. Probably by this time there will be no danger of overheating, and if so, the soil may be put on; if, however, there is any inclination to overheat, wait till it has passed off before putting on the soil. The soil used should be decomposed turfy loam, moderately dry, so as to bear compression without running together like paste, but damp enough to become firm, close, and even, when beaten closely. About two inches in thickness should be put on, and this is to be beaten down quite firm and close. The beds are then finished. It is as well to cover the surface with a thin layer of short hay, to prevent it becoming quite dry. Mushroom beds seldom require water; after they have been some time in bearing, the beds sometimes get dry, and in such cases, if they have a moderate soaking of *tepid* water, and the surface is covered as before, a new crop will spring up. The covering is best removed when the beds are in bearing. It is seldom advisable to apply water when the beds are coming into bearing. Water should never be used in any other than a tepid state.

Mushrooms are most prized in the summer, though the atmosphere of a cucumber-house would not then be suitable for them, unless the space about them could be closed in, so as to retain a close, somewhat humid atmosphere. They would succeed very well without being enclosed, during the season for forcing cucumbers.

Under the treatment which has been detailed, the beds would usually come into bearing in about six weeks from the time of spawning; and, under favourable circumstances, would continue in bearing for two or three months.



the first of these is the fact that the  
the second is the fact that the  
the third is the fact that the  
the fourth is the fact that the  
the fifth is the fact that the  
the sixth is the fact that the  
the seventh is the fact that the  
the eighth is the fact that the  
the ninth is the fact that the  
the tenth is the fact that the  
the eleventh is the fact that the  
the twelfth is the fact that the  
the thirteenth is the fact that the  
the fourteenth is the fact that the  
the fifteenth is the fact that the  
the sixteenth is the fact that the  
the seventeenth is the fact that the  
the eighteenth is the fact that the  
the nineteenth is the fact that the  
the twentieth is the fact that the  
the twenty-first is the fact that the  
the twenty-second is the fact that the  
the twenty-third is the fact that the  
the twenty-fourth is the fact that the  
the twenty-fifth is the fact that the  
the twenty-sixth is the fact that the  
the twenty-seventh is the fact that the  
the twenty-eighth is the fact that the  
the twenty-ninth is the fact that the  
the thirtieth is the fact that the  
the thirty-first is the fact that the  
the thirty-second is the fact that the  
the thirty-third is the fact that the  
the thirty-fourth is the fact that the  
the thirty-fifth is the fact that the  
the thirty-sixth is the fact that the  
the thirty-seventh is the fact that the  
the thirty-eighth is the fact that the  
the thirty-ninth is the fact that the  
the fortieth is the fact that the  
the forty-first is the fact that the  
the forty-second is the fact that the  
the forty-third is the fact that the  
the forty-fourth is the fact that the  
the forty-fifth is the fact that the  
the forty-sixth is the fact that the  
the forty-seventh is the fact that the  
the forty-eighth is the fact that the  
the forty-ninth is the fact that the  
the fiftieth is the fact that the  
the fifty-first is the fact that the  
the fifty-second is the fact that the  
the fifty-third is the fact that the  
the fifty-fourth is the fact that the  
the fifty-fifth is the fact that the  
the fifty-sixth is the fact that the  
the fifty-seventh is the fact that the  
the fifty-eighth is the fact that the  
the fifty-ninth is the fact that the  
the sixtieth is the fact that the  
the sixty-first is the fact that the  
the sixty-second is the fact that the  
the sixty-third is the fact that the  
the sixty-fourth is the fact that the  
the sixty-fifth is the fact that the  
the sixty-sixth is the fact that the  
the sixty-seventh is the fact that the  
the sixty-eighth is the fact that the  
the sixty-ninth is the fact that the  
the seventieth is the fact that the  
the seventy-first is the fact that the  
the seventy-second is the fact that the  
the seventy-third is the fact that the  
the seventy-fourth is the fact that the  
the seventy-fifth is the fact that the  
the seventy-sixth is the fact that the  
the seventy-seventh is the fact that the  
the seventy-eighth is the fact that the  
the seventy-ninth is the fact that the  
the eightieth is the fact that the  
the eighty-first is the fact that the  
the eighty-second is the fact that the  
the eighty-third is the fact that the  
the eighty-fourth is the fact that the  
the eighty-fifth is the fact that the  
the eighty-sixth is the fact that the  
the eighty-seventh is the fact that the  
the eighty-eighth is the fact that the  
the eighty-ninth is the fact that the  
the ninetieth is the fact that the  
the ninety-first is the fact that the  
the ninety-second is the fact that the  
the ninety-third is the fact that the  
the ninety-fourth is the fact that the  
the ninety-fifth is the fact that the  
the ninety-sixth is the fact that the  
the ninety-seventh is the fact that the  
the ninety-eighth is the fact that the  
the ninety-ninth is the fact that the  
the hundredth is the fact that the



YA 04607

